PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

SEPTEMBER 1957

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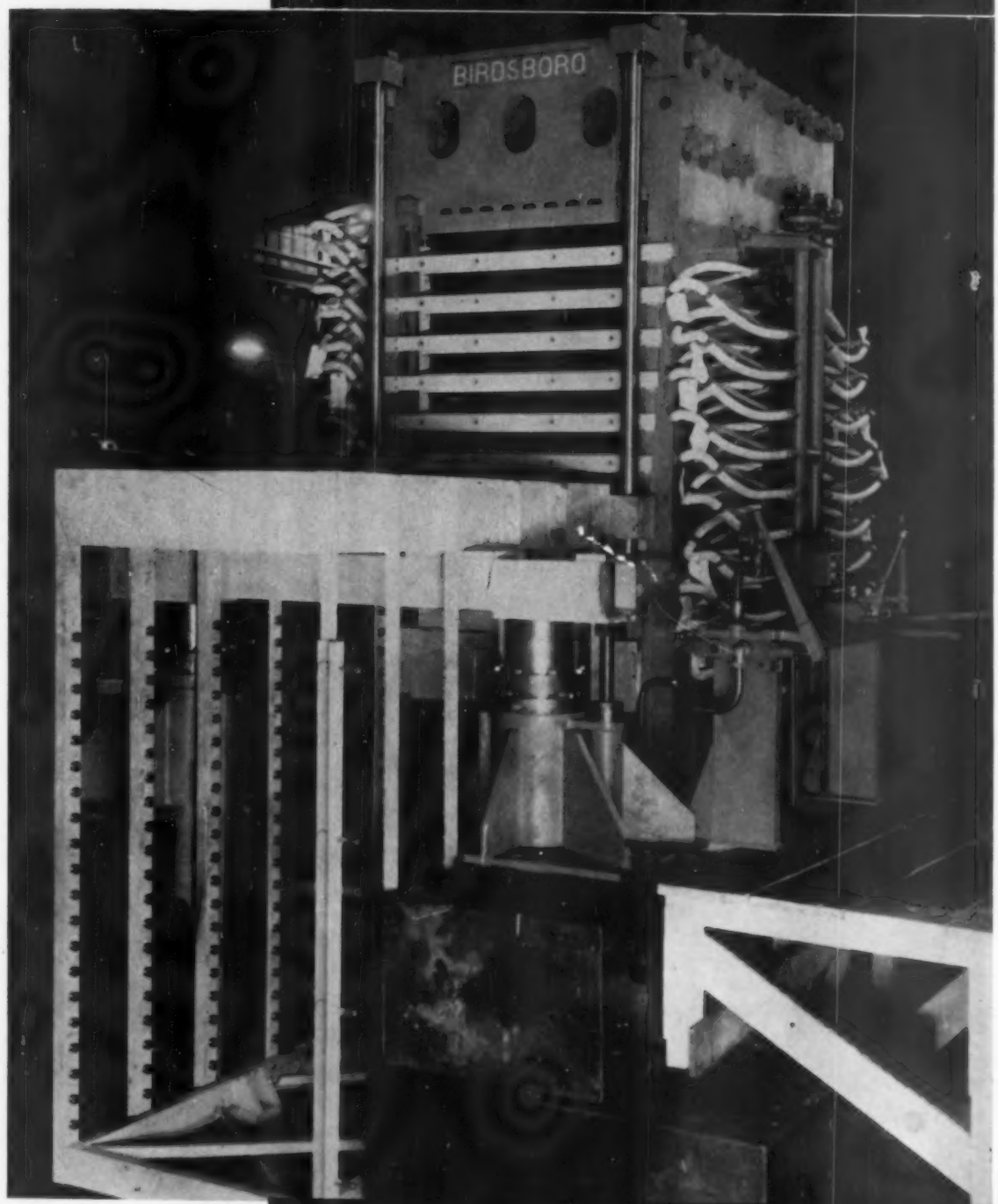

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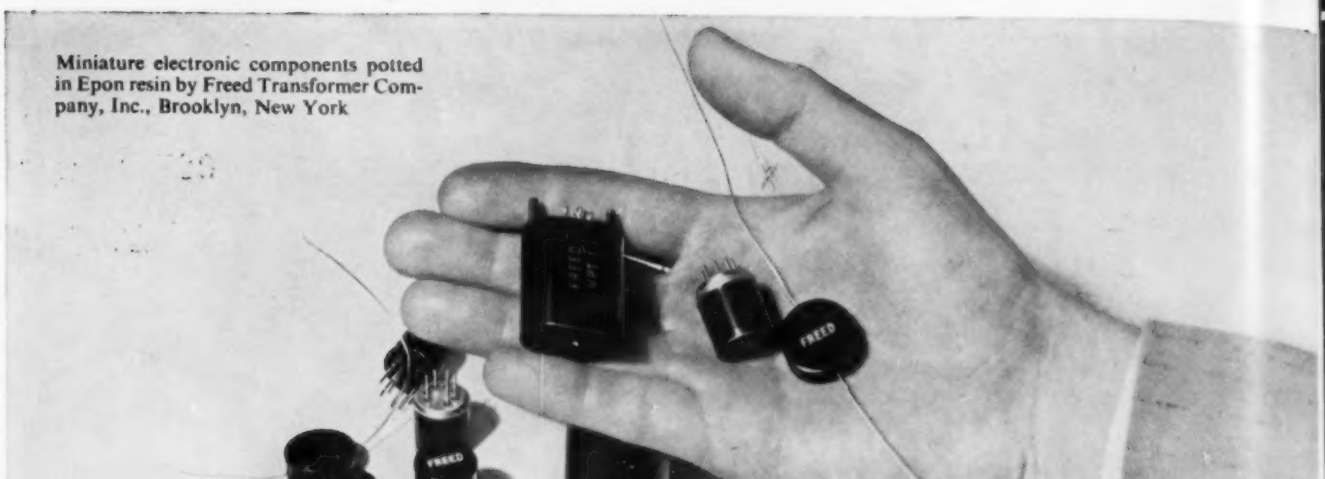

Miniature electronic components potted in Epon resin by Freed Transformer Company, Inc., Brooklyn, New York

Why **EPON®** **RESINS** for potting?

4 Good Reasons!

1. Outstanding adhesion to metal, glass, plastics
2. Excellent dimensional stability
3. High mechanical strength
4. Excellent dielectric properties

EPON RESINS are preferred for potting, laminating, sealing and encapsulating because they offer an almost ideal combination of electrical and physical properties.

Potting and encapsulating. Epon resins have outstanding adhesive properties. They form strong bonds to metal and glass, provide airtight enclosure of delicate components and vacuum tubes. They also have excellent dimensional stability and can withstand solder bath temperatures.

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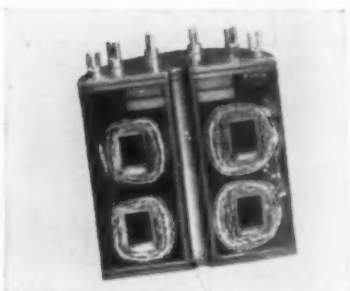
Laminating. Epon resins, laid up with inert fibrous fillers, produce base laminates of superior dielectric properties which can be sheared, punched, drilled and bath soldered.

Adhesives. Solvent-free Epon resin formulations cure at room temperature, with contact pressure alone; form powerful bonds between glass, metal, wood or plastic.

Write for complete information on the use of Epon resins in protective enamels, tool and die materials, etched circuit laminates, transformer and motor sealing compounds.



Section of magnetic amplifier coils embedded in Epon resin by Westinghouse Electric Corporation, Pittsburgh, Pa.

Potting transformer with Epon resin at PCA Electronics, Inc., Santa Monica, Calif.

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PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

SEPTEMBER 1957 VOLUME III NUMBER 9

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Article

Highlights

Effect of Blow-Up Ratio on Properties of Polyethylene Blown Film. (p. 711)
Tensile, elongation, impact, and tear resistance properties of blown film can be improved with a higher blow ratio. This paper describes the test procedure and resultant data leading to the conclusion that an approximate 3.5:1 blow ratio is necessary to achieve an optimum balance of all properties.

•

Automatic Pellett Deflashing of Moldings with Metal-Pin Inserts. (p. 714)
Automatic deflashing of plastic parts containing molded-in metal pins now can be safely accomplished by the use of soft pellet grits. A case history is reviewed and types of equipment available for this operation are described.

•

Synthetic Fibers in Formable Acrylic Sheet. (p. 716)
Acrylic laminates reinforced with various synthetic fibers were prepared in order to produce a readily formable sheet material. The authors discuss the effects of fiber content, mechanical properties, dimensional stability, craze resistance, and potential applications of the new sheeting.

•

Flexural Fatigue Strengths of Reinforced Thermosetting Laminates. (p. 721)
The effects of resins, reinforcements, interface reagents, and fillers on the fatigue strengths of 32 polyester, phenolic, and epoxy laminates are discussed in this article.

Previews

The following articles will be published in the October issue.

Polyester Premix Molding Compounds. W. E. Wirsch, mgr. of polyester sales, Rohm & Haas Co., Philadelphia, Pa.

Method of Evaluating Polyethylene Molding Compounds. C. S. Imig, senior staff member, Plastics Laboratory, Spencer Chemical Co., Kansas City, Mo.

Embedment, Potting, and Encapsulating Processes. C. A. Harper, materials engineer, Air Arm Division, Westinghouse Electric Corp., Baltimore, Md.

New Fabrication Techniques for Flush Circuitry. E. L. Ditz, senior engineer, and P. E. Ritt, chief chemist, Melpar, Inc., Falls Church, Va.

Letters to the Editor

Plastic Bags, Straws, and Bands

Dear Sir:

We are in a position to supply plastic items (bags, straws, and bands) for Mr. F. T. Shaw, who wrote concerning a "Spillproof Container" in your July issue.

We shall be pleased to hear further concerning his requirements.

F. E. Newman
Plastics Production Mgr.
Baxter Laboratories, Inc.
Cleveland, Miss.

(This letter has been forwarded to the original inquirer.—Editor)

• • •

Building Reinforced Plastic Boat

Dear Sir:

I plan on building a 25-30 foot sail boat, sloop or ketch rig. I want to use fiberglass and plastic, or something equivalent, for the hull.

I will appreciate receiving any information you have on the subject, and any further sources of information you might suggest.

Ross Chatelain
Kalamazoo, Mich.

(Since we do not have any detailed printed material to send Mr. Chatelain, we have referred him to some of the resin suppliers who we feel can supply the desired information. We print this letter only to illustrate a type of inquiry we receive continuously.—Editor)

• • •

Translucent Vinyl Sign

Dear Sir:

In your New Products section under Readers' Service Item P-5, we note with interest a one-piece vinyl sign manufactured by Emet Plastics Corp.

We are the oldest and largest distributor of point-of-purchase items to the Dairy Industry, nationally. As such, we would be interested in the possibility of distributing this sign to that industry.

We would appreciate it if you would pass this information on to the manufacturer.

John E. Holing, Sales Mgr.,
Merritt Products
Azusa, Calif.

(We were happy to refer Mr. Holing's letter to Emet Plastics.—Editor)

Corrects August Mention

Dear Sir:

We have noted with interest on page 669 of your August issue, under New Products, the brief description of our prefoamed epoxy resin blocks. We would like to point out two corrections in the copy, as follows:

(1) The name of the company manufacturing this foam is D & R Pilot Plants, Inc.

(2) The tradename of the foam material is DuRafoam.

We wish to express our appreciation for the publicity, and merely wish to point out these corrections for the record.

Machado Mead
D & R Pilot Plants, Inc.
Hazardville, Conn.

(We gladly stand corrected and take this opportunity to modify our New Products write-up, Readers' Service Item P-5, in the August issue.—Editor)

• • •

Wants Special Plastic Sheeting

Dear Sir:

We are interested in obtaining a plastic sheet measuring 15½ by 23 by ¾-inch that is capable of withstanding 2,000 psi. rolling pressure, can be sawed and shaved, and take rough handling without chipping or denting. Heat and acid resistance are not factors.

We would greatly appreciate contacting firms which can produce the above or any other information on sheeting of this kind.

Morris Horovitz
318 Thornridge Drive
Levittown, Pa.

• • •

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

A letter will not be printed if publication is not desired by the sender.

Letters requesting information on technical or engineering problems will be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.

—The Editor

"Quote . . . Unquote"

Industrial Role of Research

"We have only to look about us to recognize that industry, through its research, has been responsible for most of the physical progress our civilization has made. It pours millions and millions of dollars into the development of new products, better ways of doing things, with the profits from already successful products picking up the check until, ultimately, the new product is able to stand on its own feet and return its own profit.

"Many, of course, never do pay off, but the net result of the system improves our civilization, benefits everyone—the owners, the employees, the consumers. None of the things which we rather take for granted—the drugs, the fibers, the plastics and so on—would have been brought about if industrial management had not accepted that dual economic and social responsibility.

"We are now just in the early stages of what everyone seems to refer to lightly as the 'atomic age.' We don't even have any idea what the atomic age is. It's too early in the game. We have just discovered a few new things about the atom that have opened up great new vistas of potentiality.

"Industry cannot claim sole credit for the basic discoveries. But I am sure of one thing—that the fruits of atomic energy, the 'atomic age,' whatever it turns out to be, will be brought about only through industrial management pouring heaven-knows-how-many millions into this new area of exploration. I am sure industry will do this as it has done with all the other major developments of the past."

Dr. L. I. Doan, Pres.
The Dow Chemical Co.,
Midland, Mich.

• • •

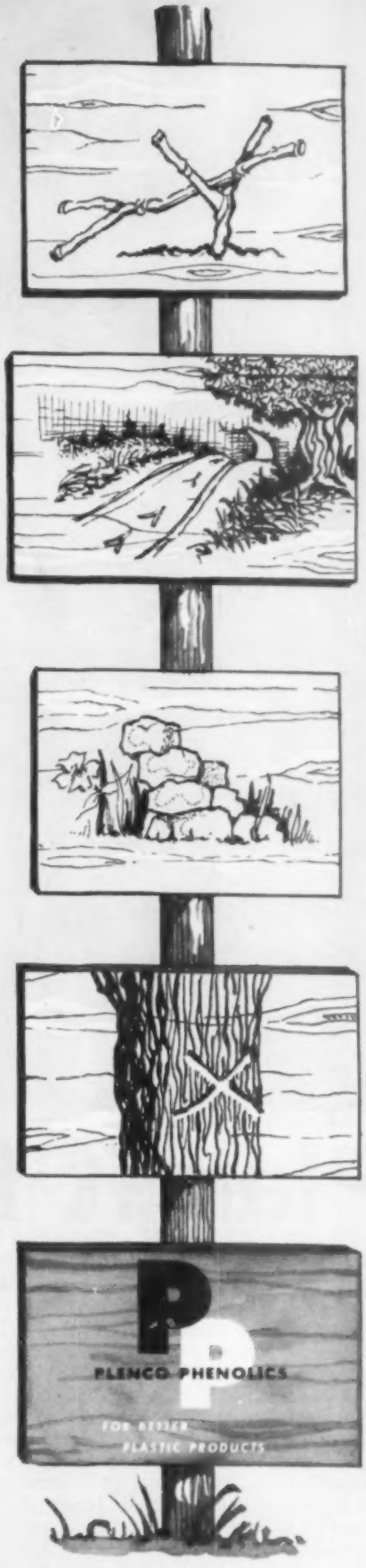
Plastics in Building Today

"Plastics are today used in appreciable quantities in building for a wide variety of applications: as auxiliaries to other materials, in nonstructural applications, and as structural and semi-structural components. Their increasing use depends on an understanding of their properties and limitations so that full advantage may be taken of the former and the latter may be overcome by imaginative design. As architects, engineers, builders and owners become more familiar with them, and as the record of application grows, they will find their proper place in company with the other materials of building."

Professor A. G. H. Dietz
Mass. Inst. of Technology
Cambridge, Massachusetts

• • •

The trail is well-marked for alert designers and manufacturers who seek the help of quality phenolic molding compounds



PLENCO

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Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

Planning a new line?

*TRADEMARK FOR W. R. GRACE & CO.'S POLYOLEFINS

Plan it for profit...with GREX*

Planning a brand-new, sales-building line . . . or putting new life into an old favorite . . . look *first* at the newest in resins—GREX.

Could you use a plastic that takes to boiling water without losing shape—yet sits in a freezer and doesn't go brittle? Or does your product have to hold acid, or gas? GREX will do all this.

You may be looking for greater lustre. GREX gives a brilliant, glossy finish and true, consistent color. Need added strength in thin sections? GREX is tough . . . *rigid.*

GREX will do *more,* too. It will form intricate shapes and fine detail, still holding its strength!

And GREX is economical, because with this high density polyethylene, you make more items with less resin, maintain desired strengths, and gain these extra benefits at the same time.

Tie these advantages to your own needs and your plans. Write us today concerning your particular requirements. We will gladly send further details and specifications, or assist you in any other way.

W. R. GRACE & CO.
POLYMER CHEMICALS DIVISION

Plant
Baton Rouge, La.

Offices
Clifton, N. J.

NEWS in BRIEF

Glass-reinforced polyester hoods have been adopted by three major manufacturers of outboard motors. A total production of more than 25,000 hoods is expected this year by the maker, General Tire & Rubber Co.

Plastic linings convert old industrial tanks into usable systems. Developed by Haveg Industries, such plastics as asbestos-filled phenolics, graphite-filled epoxies, and glass-reinforced polyesters are used to mold or cement a chemically-resistant lining or inner tank into the old structure. Successful installations, using the old structure as a mold, have been made in steel, wood, and concrete vessels up to 55 feet in diameter.

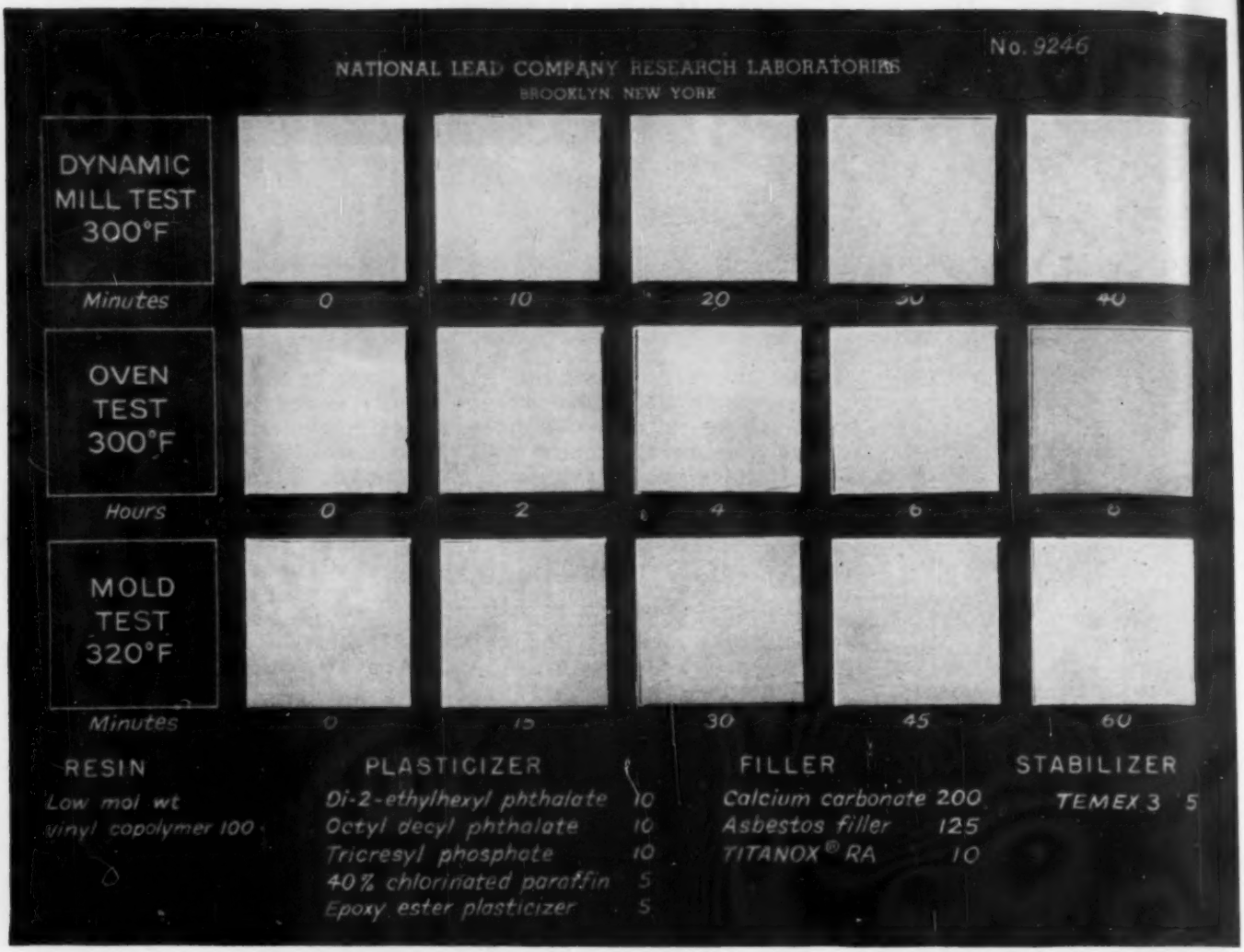
Company developments in the plastics industry saw Auburn Button Works, Inc., change its name to Auburn Plastics, Inc., to better indicate the nature of the firm's business. Anticipating an increased demand for plastics in the field of construction, Dow Chemical Co. formed a building products group as part of its technical service organization. Liberty Laminates, a new division for the production and development of specialty laminates, has been formed by Liberty Corrugated Container Corp. To broaden its sales coverage, The Rainville Co., Inc., has opened three new district branches, appointed three organizations as sales representatives, and expanded its staff in existing offices.

Company expansions in the news this month are plentiful in number. Construction work is nearly completed on Cryovac Co.'s new plant in Simpsonville, S. C., and new converting plant in Toronto, Canada. Deecy Products Co. completed new facilities for plasticizer production at Cambridge, Mass.A new petrochemicals plant has been built by Delhi-Taylor Oil Corp., Corpus Christi, Tex. An expansion program is underway at the Texas City, Tex., acrylonitrile plant of Monsanto Chemical Co. A new plant for urethane foam production and research was opened at North Arlington, N. J., by Nopco Chemical Co. A new molding plant at Gastonia, N. C., has been built by Northwest Plastics, Inc. A new phthalic anhydride plant has beenerected on Neville Island, near Pittsburgh, Pa., by Pittsburgh Coke & Chemicals Co. A new plastics fabricating plant is being built by Plastics Age Co., San Fernando, Calif. An adhesives research and testing laboratory was erected by Raybestos-Manhattan, Inc., at Stratford, Conn. Spencer Chemical Co. will double polyethylene output at its Orange, Tex., plant. Plans to step-up its activities in the field of foamed vinyls and other resins have been announced by Union Carbide Corp.

New Materials to be noted (see pages 744-7): fibrous glass-reinforced polyester to meet military specifications; three stabilizers for vinyls; low-viscosity plastisol for rigid vinyl; fast-curing, two-step phenolic molding material; modified alkyl phthalate plasticizer for vinyls; three general-purpose PVC resins; and concentrated neutral wetting agents.

New Equipment of special interest (see pages 748-51): hot air convection ovens; extra durable cutting rule steel; static eliminating bar; hydraulic laminating press; deep-throat punch press; combination granulator-loader; and a plastic skin packaging unit.

New Products worthy of mention (see pages 752-4): signs of glass-reinforced polyester; PVC pipe and drainage fittings for corrosive wastes; all-plastic industrial wheels of nylon-reinforced polyester; unbreakable, lightweight, precision-made plastic lenses; right-angle elbow of glass-reinforced polyester for fume duct systems; press-molded glass-polyester glazing; disposable, blow-molded polyethylene drums; Teflon-coated, glass-reinforced fabrics; vacuum-formed display pieces of white butyrate sheeting; complex custom extrusions; and heat-sealable tape with polyester adhesive.



How's this for color retention?

New stabilizer..."Dutch Boy" Temex 3... gives 3-way better color control in vinyl-asbestos flooring

This test card shows what you can expect from asbestos-filled vinyl flooring stocks stabilized with the new "Dutch Boy" stabilizer . . . Temex 3.

In these stocks, this specially-developed barium-zinc compound gives you a 3-way better control over color during processing:

Best yet for heat stability

Mill, mold and oven tests are alike in demonstrating that "Dutch Boy" Temex 3 stabilizer provides greater heat stability than ever before attainable for vinyl asbestos-filled flooring.

Complete freedom from interactive color change

Temex 3 stabilizer has minimum reactivity . . . does away with pinking, bluing and other color shifts associated with interaction between stabilizer and filler impurities.

No harmful lubricity

Temex 3 stabilizer adds no lubricity to the compound. At any recommended level of stabilizer, critical color values in whites and pastels can be maintained . . . color separations kept sharp.

Steps up color life, too

Along with improved color control during processing, "Dutch Boy" stabilizer Temex 3, also assures improved color life after flooring is laid . . . preventing discoloration or staining by sulfur compounds.

Other "Dutch Boy" stabilizers meet other vinyl flooring needs . . . Tribase and Normasal®, for other loaded stocks . . . Clarite®, for homogeneous non-asbestos stocks. Still others . . . seventeen more, in fact . . . improve other vinyl products.

Seeking to improve *your* vinyl formulations? If so, look into these versatile "Dutch Boy" stabilizers. A new edition of the "Dutch Boy" Stabilizer Handbook is available. Ask for a copy.

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY
111 Broadway, New York 6, N. Y.
In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West, Montreal

PLASTICS TECHNOLOGY

SEPTEMBER, 1957

EDITORIAL: Training and Educating Plastics Manpower

After examining and considering the current status of the plastics industry and its manpower, we believe the time has come to repeat and reemphasize some of the thoughts expressed in our editorial of June 1955 so that we can "repair the barn door before the cattle are strayed or stolen."

•

A casual survey of the technical manpower in the plastics industry reveals that the materials suppliers have a preponderance of chemists and chemical engineers in their laboratories, technical service staffs, and sales forces. This condition of technical manpower selectivity is almost non-existent in the plastics processing (molding) field, however, and training varies considerably. We find technical degrees, non-technical degrees, and even persons with no formal degrees among the personnel of this phase of the industry.

But what of the future? Is the industry to continue to recruit its personnel in this haphazard manner, or will it attempt to fill its personnel requirements by means of a planned program? It is obvious that the latter course is to be preferred, and a system of education and training is the means to this end.

This educational approach to answer manpower needs should be two-pronged in nature, and consist of: (1) formal education at the college or university level; and (2) an "in-industry" training program.

In the education phase, plastics should be included in the curricula of all colleges and universities. This has been taking place in recent years, but most of the courses offered are of a theoretical or fundamental nature. While the student receives an education in plastics theory, he is not given an opportunity to translate this knowledge into actual molding practice. What is needed in this formal education is more emphasis on actual plastics practice, in addition to plastics theory.

The "in-industry" training program must be industry-wide, rather than be given only by a few companies, and be designed to upgrade the knowledge of the younger and newer personnel. A start in this direction has been made in the rubber industry where some of the local rubber groups are giving courses taught by authorities from industry and emphasizing practical knowledge. This approach is needed in the plastics industry where the national or local societies could take the lead in meeting this need.

The proposed program, then, would consist of two approaches, each complementing and supplementing the other; college training in plastics, followed by industry training. With such a program, the industry could be assured of a continuing supply of technical manpower that was properly educated and trained in plastics.

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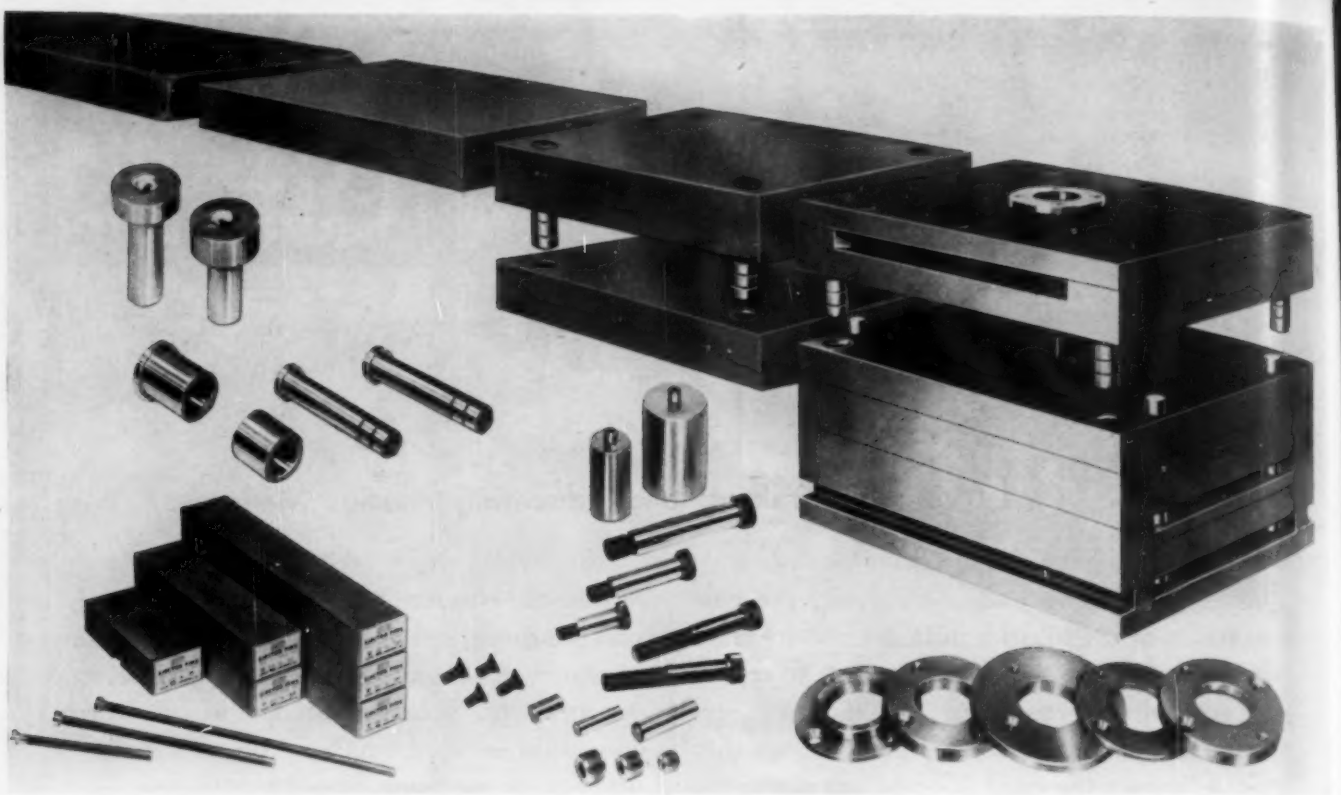
We invite comments from our readers on this proposal, and stand ready to join with the industry in formulating a positive program of action that would remedy the situation before it becomes critical and too late.

Arthur M. Merrill

Editor



PROGRESS THROUGH STANDARDS

. . . and how DME "helped"

The history of economy in modern business has been directly related to the history of Standardization. One of the major elements affecting the economic production of finished plastic parts is the high initial cost of the mold. A progressive step in reducing mold cost, without sacrificing the high quality required, has been successfully achieved through Standardization.

When D-M-E originated Standard Mold Bases and their component parts in 1942, it provided the answer to the rapidly growing demand for high quality molds that would maintain and promote the economic advantages of plastic parts.

Through large volume purchases of quality steel in standard sizes and specialized production facilities, D-M-E was able to produce and supply high quality Standard Mold Bases to mold makers and molders at such great savings in cost and time that the benefits of Standardization were quickly realized by the Industry.

Today D-M-E produces twenty-eight different sizes of Standard Mold Bases from 9⅞" x 8" to 23¾" x 35½", in either D-M-E No. 1 or No. 2 Steel, with a wide range of cavity plate thicknesses to satisfy the diversified demands required. In addition, over 2,000 finished component parts of the same high quality are available to provide additional savings in service as well as in the product.

Properly engineered Standardization puts the accent on Economy. When you "Specify D-M-E . . ." you get Quality, Service AND Economy!

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TORONTO 18, ONTARIO—156 Norseman Ave., BElmont 3-3274

PLASTICS TECHNOLOGY

Effect of Blow-Up Ratio on Properties of Polyethylene Blown Film

Test results show that a blow-up ratio of about 3.5:1 is needed for a good balance of tensile, elongation, and tear properties.

C. G. KUCHER,* *Staff Member,*
Plastics Laboratory,
Spencer Chemical Co.
Kansas City, Mo.

THE greatest advantage for blown film over flat film is that biaxial orientation is obtained with the former. It is desirable, of course, to have a balance of properties in both machine and transverse directions in order to have a uniformity of strength.

It is generally accepted that a higher blow ratio, which is defined as the ratio of the bubble diameter to the die diameter, gives improved tensile strength, elongation, impact strength, and tear resistance. In order to determine how each of these properties are affected with variations in blow ratio, the data herein presented was obtained.

On the basis of the results of these tests, we have determined that an optimum blow ratio for the best balance of most properties is approximately 3.5:1. We appreciate the economic fallacy of having a die for each size of blown film, but it seems feasible that conditions as near optimum as possible should be considered in all cases.

* Now Senior Technical Service Representative for the Eastern area, and based in Spencer's New York offices.

Based on a paper presented at the 13th annual National Technical Conference, Society of Plastics Engineers, Inc., St. Louis, Mo., Jan. 16, 1957.

Charles G. Kucher was born in Newark, N.J., on June 2, 1922. He attended high school in Irvington; the Peddie School in Hightstown; and was graduated from Lehigh University, Bethlehem, Pa., with a B.S. in chemical engineering. He joined Atlas Powder Co. in 1943, serving as a production supervisor. In 1945, he went with Irvington Varnish in the capacity of development engineer and, in 1948, he set-up his own custom extrusions firm, Dumont Mfg. Co. Mr. Kucher also served as development engineer with Gering Products from 1950-1955, at which time he joined the laboratory staff of Spencer Chemical Co.

Mr. Kucher is now a technical service representative for Spencer in the East. A member of Theta Xi and the Society of Plastics Engineers, he lives with his wife and two children in Westfield, N.J.

Test Procedure

All film was made on a 2½-inch extruder using a three-inch blown film die with an 0.020-inch opening. The pinch rolls on the take-up were 24 inches wide. The extrusion direction was upwards, and the nominal blow ratios studied were 0.5:1, 1:1, 2:1, 3:1, and 4:1, so that lay-flat widths of about 2-⅜, 4-¾, 10, 15, and 18 inches were obtained. The screw speed was changed only where necessary to adjust the film output to the limiting speed of the take-off. This occurred primarily when the smaller lay-flat widths were made. The stock temperature was recorded when the screw speed was changed.

High-slip resins Poly-Eth 2235 and 2455 were used. The former has a density of 0.920, while the latter has a density of 0.925.

Test Results

Tensile Properties

The tensile properties of the film samples for the machine and transverse directions were determined according to ASTM D882-54T, Method A, using one-inch wide strips. A Tinius Olsen Electromatic Testing Machine equipped with a load cell was used in the tensile tests. The results of these tests, as seen in Figure 1, show that the tensile strength decreased in the machine direction and increased in the transverse direction for both resins studied. Here, we see that equal values for tensile properties were obtained at a 3.3:1 blow-up ratio for the 2235. The values for 2455, although slightly lower, show a tensile balance at the same blow-up ratio.

The graph of Figure 2, on the effect of blow ratio on film elongation, shows the same trend as tensile strength, but with an increase in the machine direction and a decrease in the transverse direction. Equivalent elongations for both directions of films made from both resins was indicated at a 3.8:1 blow ratio. To obtain a near balance of tensile properties, therefore, we can assume that a blow-up ratio of from 3:1 to 4:1 is desirable.

Impact Strength

The testing of film samples for impact strength was done with a machine developed by our company's technical department. It is basically an Elmendorf Tear Tester that has been modified to indicate impact strength, and the manufacturer of the Elmendorf tester is willing to supply the modified instrument where the front of the swinging arm is extended and mounted with a half-sphere puncturing head; the swinging arm is weighted to counterbalance the front arm; and a sample holder has been added.

As in tear testing, zero reading for free swings is obtained by adjustment. The film thickness is measured to the nearest 0.1-mil, placed over the sample holder inner ring and held smooth, but is not stretched. The outer ring, which is similar in construction to an embroidery hoop, then is put in place. The next step is to release the swing arm which ruptures the sample.

The impact strength is calculated from the scale reading, the film thickness, and the diameter of the puncturing head by the following formula:

$$\text{Impact (psi.)} = \frac{0.0876\ DR}{T}$$

where D is the diameter, in inches, of the puncturing head; R is the scale reading; and T is the thickness in inches. The factor, 0.0876, was calculated from the predetermined energy available at the sample holder, and includes conversion to an impact value of pounds per square inch. The values obtained are shown in Figure 3.

The results of tests of these films on the Spencer Impact Tester show that impact strength increases with blow-up ratio. Dotted lines indicate the impact value obtained at the previous choice of optimum blow ratio for the best balance of tensile properties.

A few sandbag-drop tests were made to show degree of correlation with Spencer Impact Test data. The sandbag test used was developed by John G. McMillan of the University of Omaha and Howard Plastics, and has been published. In this test, the size of the bag determines the weight of sand to be used and the number of drops to be made from standard heights of one, two, and 2½ meters.

Experience has shown that when relatively wide bags are used in this test, they rarely land squarely and, therefore, give quite unreproducible results. Only films made at blow-up ratios of 1.5:1, 1:1, and 2:1, and having widths less than 10 inches, were studied. As shown in Table 1, the results of this test also confirmed that

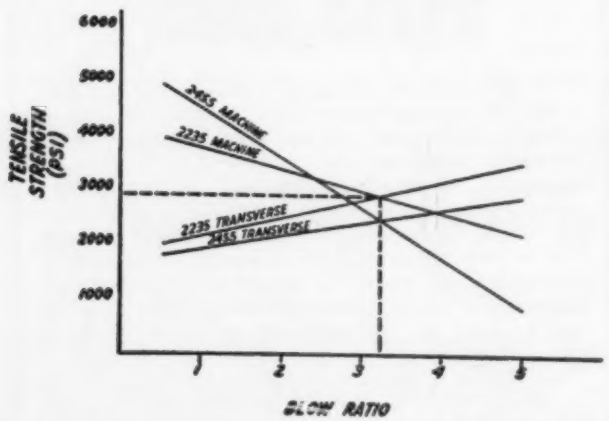

Fig. 1. Effect of blow ratio on tensile strengths of Poly-Eth 2235 and 2455 films tested in both machine longitudinal and transverse directions.

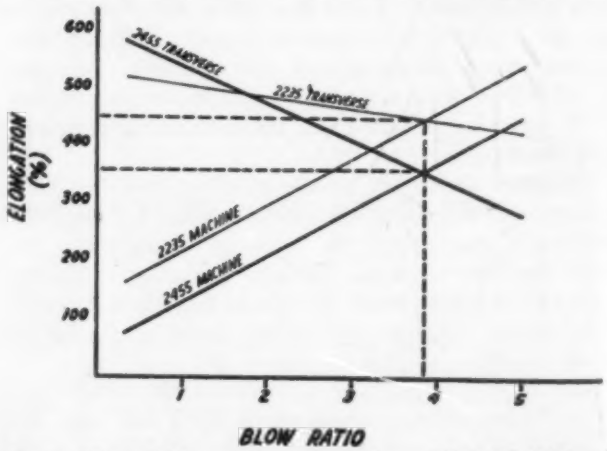

Fig. 2. Effect of blow ratio on elongations of Poly-Eth 2235 and 2455 films tested in both machine and transverse directions.

Table 1. Results of Sand-Bag Drop Tests.

Poly-Eth Resins	Blow Ratio	Drop Test Heights, Meters		
		One	Two	2.5
2235	0.5:1	O.K.	Broke	—
	1:1	O.K.	O.K.	Broke
	2:1	O.K.	O.K.	O.K.
2455	0.5:1	O.K.	Broke	—
	1:1	O.K.	O.K.	Broke
	2:1	O.K.	O.K.	Broke

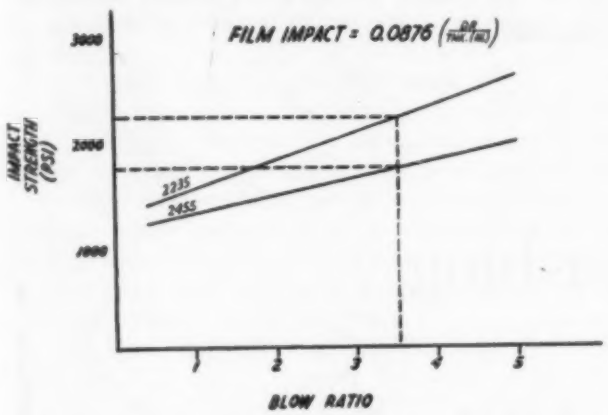

Fig. 3. Effect of blow ratio on impact strengths of Poly-Eth 2235 and 2455 films.

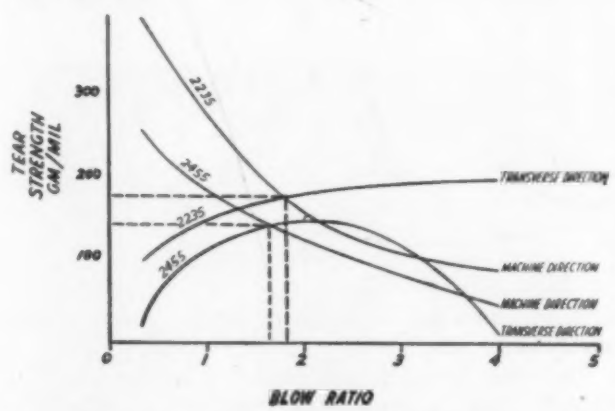

Fig. 4. Effect of blow ratio on Elmendorf tear strengths of Poly-Eth 2235 and 2455 films tested in both machine and transverse directions.

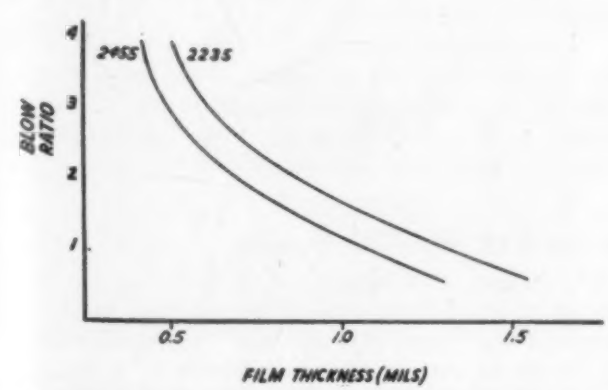

Fig. 5. Effect of blow ratio on minimum consistent thickness of Poly-Eth 2235 and 2455 films.

better resistance to shock or impact is obtained with increasing blow ratio.

Tear Strength

The tear strength values were determined according to ASTM D689-44, using an Elmendorf Tear Tester. The only deviations from the stated method were the use of single-thickness film samples, and the use of a correction for length of tear. This latter correction (for length of tear) has been adopted as standard procedure in our laboratory because many polyethylene film samples do not tear parallel to the test direction, probably as a result of orientation. This phenomenon was more apparent with Poly-Eth 2235 than with Poly-Eth 2455, which is a slightly more linear polymer.

As shown in Figure 4, machine-direction tear strength decreased in both resins with increasing blow ratios. A comparison of transverse tear strengths, however, shows that the 2235 increased to a point and then tended to level off, while the 2455 tear strength increased to a point and then decreased.

Slip Valued

The slip value, or coefficient of friction, was determined for all film samples. This test was performed by using a film-covered wood sled drawn across a stationary, film-covered piece of wood that was attached to a load-indicating device. The indicator used was a Tinius Olsen Electromatic Testing Machine having the previously-described load-cell attached. A graph also was plotted during the test to show any variations of slip across the surface being tested. The slip values for both Poly-Eth 2235 and 2455 were found to be the same, regardless of blow-up ratio.

Consistent Minimum Gage

One other point of interest was the effect of blow ratio on the thinnest consistent minimum gage that could be run with a given resin. When evaluating the characteristics of new resins, thought should be given to this thinnest practical gage, especially with new higher-density or stiffer resins. In evaluations of this type for a given blow-up ratio, we speed up the take-off to draw the film until it breaks, and then reduce the take-away speed very slightly and re-blow the bubble. If no breaks occur upon continuous operation at this setting, the thickness of the film is considered to be the minimum consistent gage.

The data obtained with the two resins studied are shown in Figure 5. It will be noted that although different values were obtained for each resin, the shape of each curve was the same and the thinnest minimum consistent gage was obtained at increased blow-up ratios.

Another observation was that thickness uniformity was controlled more easily at blow ratios above 1:1 when any given screw speed was used. Although other factors, such as rate of cooling, may contribute to this, we have found generally that best gage control is obtained with blow ratios of about 2:1 to 4:1. More variation was experienced at ratios of 0.5:1 and 1:1 than could be compensated for by adjustments of the die.

(*Continued on page 720*)

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Automatic Pellet Deflashing of Moldings with Metal-Pin Inserts

How tumble-blast machines are used to automatically deflash small parts having metallic inserts

AUTOMATIC pellet deflashing of thermoset moldings at H. H. Buggie, Inc., has been found especially advantageous for plastic parts having a number of molded-in metal pins. The process speeds deflashing by doing hundreds of intricate parts in the same time that manual methods can do only a few. Equally important, however, is the fact that these pins can be deflashed without scratching the plated metal.

The above-mentioned firm manufactures components for makers of electronic equipment. Their products include connectors, pressurized and non-pressurized plugs, jacks, receptacles, terminal and contact strips, printed circuit connectors, and cable assemblies. The company has its own captive plastics molding department for producing items required by these components.

The moldings are made from phenolics, glass-filled melamines, straight or unfilled melamines, and Orlon-filled diallyl phthalates. In many cases, the molded pieces have metal pins of brass and phosphor bronze (see Figures 1 and 2). All the pins are plated; most of them with gold, but some with Albaloy, silver, or tin. The plant operates three eight-hour shifts per day, and the molding department makes about 10,000 moldings per day.

Deflashing formerly was done manually with knives, files, and fixtures, and required about 160 man-hours of labor per day. Automatic pellet deflashing now does the entire production of the three shifts in less than an hour's time, and only one person is needed to run the machine during this time.

It is estimated that automatic pellet deflashing saves the department about $20,000 a year, principally in labor costs. In addition to saving more than 159 man-hours per day, the company also saves repeated tooling costs and production department floor space.

Automatic Pellet Deflashing

Automatic pellet deflashing is done by hurling non-abrading, soft-grit pellets onto the moldings which are enclosed in a cabinet-type machine. The hurling is done by means of centrifugal force imparted by a rotating, bladed wheel or wheels in the roof of the machine.

The pellets are made of such material as crushed

apricot pits or crushed nut shells, or a mixture of the two. This type of material can be hurled with enough energy to remove flash and burrs from the molded parts, but not with too much energy so that the parts are broken.

Deflasher Types

Although the Buggie company uses only one model, several models of deflashers are available to meet specific requirements with respect to different shapes, sizes, and intricacies of moldings. The various deflasher models differ with respect to how the parts are presented to the pellet shower. This shower is in the form of a fan-shaped pattern, and a method suitable for the part in question is used to convey the part through the shower.

The most common deflasher employs a gentle tumbling action to turn the parts in the pellet shower, and tumbling is performed by an endless traveling belt in the deflashing compartment. The most common size deflashing machine of this type has a two-cubic foot load capacity which accommodates a sizeable number of parts per load, and occupies only about 26 square feet of floor space. One operator runs the machine, but his full-time attention is not necessary.

Table-type deflashers employ individual tables mounted on a spider to carry the moldings through the pellet shower. These individual tables rotate within the shower so as to increase pellet coverage. In order that all areas received deflashing action, the table-type machine requires most molded parts to be turned over once and passed through the machine a second time. On the other hand, the tumble-blast provides complete deflashing the first time, but larger and more fragile or breakable parts can be handled on the table machine without danger of breakage.

In general, the deflashing of larger parts makes use of table-type machines, whereas the tumble-blast-type unit is used for the smaller, compact pieces. H. H. Buggie uses a two-cubic foot capacity tumble-blast Wheelabrator machine (see Figures 3 and 4).

Thickness Limitation

The question naturally arises as to what thickness of flash can be removed. It has been found that the heaviest flash removable by the pellets is usually about 0.008-inch thick. Accordingly, care should be given in designing the molded part, that there are no excessively thin sections that also could be removed with the flash.

Demonstrations Available

Contributing to the success and growth of the pellet deflashing process is the fact that demonstrations can be obtained on a production basis prior to selection of equipment. These demonstration laboratories are maintained by manufacturers of pellet deflashing equipment, and interested persons may take their own moldings and have them pellet-deflashed in order to determine in advance, before any investment is made, the results that may be obtained.

(Please turn to page 720 for Figs. 3 and 4)

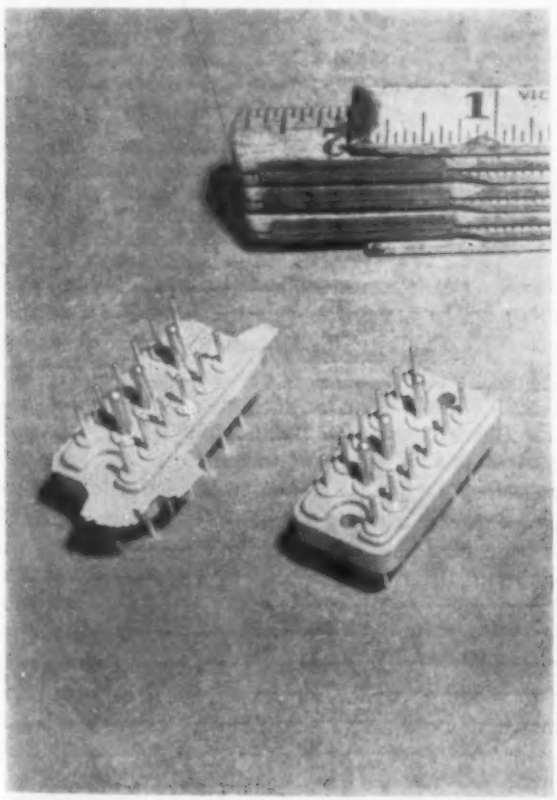

Photo courtesy of Wheelabrator Corp.

Fig. 1. 846 mica-phenolic connectors are deflashed in two minutes. Parts are shown before (left) and after (right) automatic pellet deflashing.

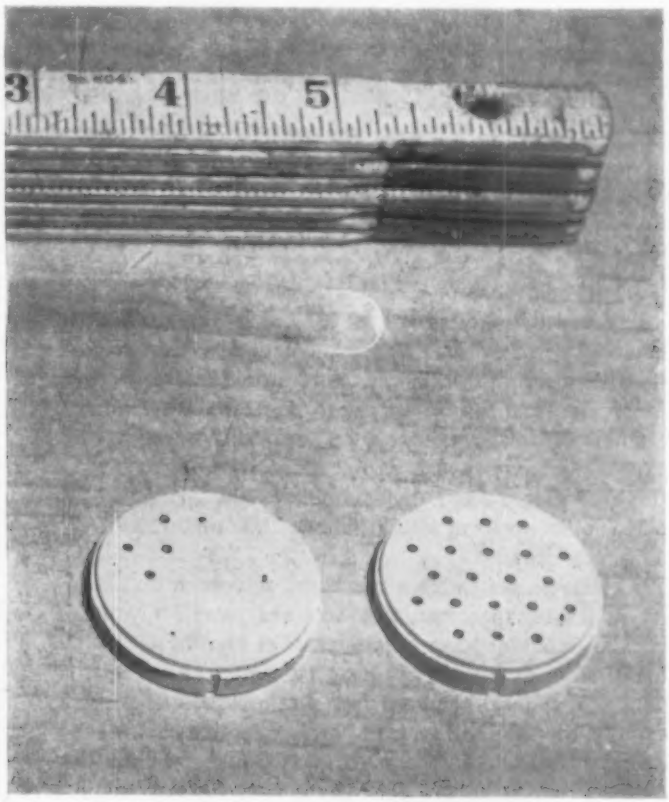

Photo courtesy of Wheelabrator Corp.

Fig. 2. Load of molded parts (left) is transformed (right) by 1½ minutes of automatic pellet deflashing.

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and
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Synthetic Fibers in Formable Acrylic Sheet

Acrylic resin sheets reinforced with various types of synthetic fibers to obtain improved properties can be formed easily by vacuum and similar techniques.

THE purpose of this work was to prepare a fiber-reinforced plastic sheet which could be shaped by vacuum forming and similar techniques. Commercial thermosetting plastic laminates reinforced with synthetic organic fibers have a certain degree of formability. Such laminates can be heated and bent through only simple curves. Because of the cross-linked structure of thermosetting resins, their laminates do not have the extensibility to form into articles with compound curves and deep draws.

Laminates made from the rigid polyesters and similar materials, therefore, can take only small advantage of the inherent thermoplasticity of synthetic fibers. More efficient use of this property could be made if a laminate were prepared from synthetic fibers and an equally thermoplastic resin. Such a laminate could be used to good advantage by that section of the plastics industry which forms flat sheets into various shapes.

Sheet Forming

A description of the sheet forming business is in order. Very briefly, its operations start with a sheet of thermoplastic material which is heated and formed into various shapes. These operations depend on the ability of the heated sheet stock to elongate or draw. The forming can be done in several ways but, regardless of the particular technique, the "blank" piece of sheet stock is clamped to a frame, heated, and stretched or drawn to the shape of a mold. If a fiber-reinforced plastic is to be used in this field, the fiber structure must be capable of stretching at least as much as the plastic matrix during the common forming procedures.

The energy used to stretch the sheet may be supplied in any of several ways. The sources of this energy are reflected in the names of the forming techniques such as vacuum, drape, air-pressure, flexible male plug, or matched mold forming. In practice, the particular

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Based on a paper originally presented at the 13th annual National Technical Conference, Society of Plastics Engineers, Inc., St. Louis, Mo., Jan. 18, 1957.

method used to produce a given shape may be any one or a combination of these, depending on the desired shape and the ingenuity of the designer. There apparently are few or no differences in the economics of the various methods except that matched molds, especially those of metal, significantly raise unit costs for short runs.

The end-uses for the formed sheets include housings, guards, panels, signs, and packagings. Large orders that specify only a few pieces of each of several designs can be filled quickly and inexpensively. The principal raw, sheet stock materials are acrylics, polystyrene, the high-impact styrene copolymers, cellulosics, vinyls, and polyethylene. The choice of a material is guided by its cost and the physical properties needed in the end-use.

Properties of Formable Sheets

Some of the physical properties of representative formable sheet materials are shown in Figures 1-3.

Figure 1 shows that several materials, due to their inherently softer natures, have higher impact strength than polymethyl methacrylate or unmodified styrene. Branched polyethylene is so soft that its impact strength cannot be measured accurately by the Izod method.

The achievement of impact resistance through the use of a softer composition carries with it certain penalties in other properties. For instance, the lower tensile strengths of the high impact materials are shown in Figure 2. The lower moduli of these materials are shown in Figure 3. These effects are symptomatic of a general relaxation of mechanical properties, including hardness and heat distortion. This interrelation of properties means that whatever material is selected, a balance will be struck between impact strength on one hand, and stiffness, strength, hardness, etc., on the other.

These restrictions on properties of the available raw materials point out at least two end-use areas whose specifications cannot be met. First, there is no formable sheet which has really good weatherability as well as high impact strength, craze resistance, nailability, etc. Second, there is no high impact formable sheet which has the strength, stiffness, etc., of the so-called "hard" polymers like the acrylics and polystyrene.

Formable Fiber-Reinforced Sheets

The object of this work, therefore, was to prepare a formable, fiber-reinforced laminate with properties not now available in formable sheet material. Polymethlmethacrylate was chosen for the resin principally because of its excellent weatherability. Test sheets were made in the laboratory by saturating the fibrous reinforcing structure with a viscous solution of Lucite* 40 acrylic resin in methyl methacrylate containing a catalyst, preferably benzoyl peroxide.

The sheets were cured in a press at a pressure of 50 or more pounds per square inch and at temperatures up to 100 C. The press cycle usually ran about 30 minutes. While this is a long cycle, particularly in comparison to those in use for polyesters, our objective was primarily the study of the contributions of synthetic fibers rather than optimum sheet production methods. Laminators familiar with acrylic materials no doubt will be able to determine conditions for more rapid operation.

Most of the laminates were made with the fiber in the form of a blanket-like material called needled batt. This structure, which now is commercially available, consists of random, non-woven fibers perhaps 2-4 inches long which are held together mechanically due to a needle-punching operation. Other structures, such as woven cloth and synthetic fiber papers, also were used. The properties of the reinforced sheets were more dependent on the nature of the fiber and fiber content than on the structure of the reinforcement.

Acrylic laminates reinforced with several synthetic fibers were prepared. Those sheets containing Orlon** acrylic fiber were formable by the simple vacuum technique. Square boxes were vacuum formed at 160° C. from sheets containing 15% Orlon acrylic fiber batt, and the depth of forming was over one-half the width of the formed area. The textured surface of the formed area was due to the flow of the plastic around the fibers so as to outline in relief the holes left in the batt by the needle-punching operation.

Figure 4 shows the relation of the surfaces of formed areas to the structure of the fiber reinforcement. Paper reinforcement gave formed surfaces which were decidedly smoother than the others; a woven cloth overlay

*Du Pont trademark.
** Du Pont trademark

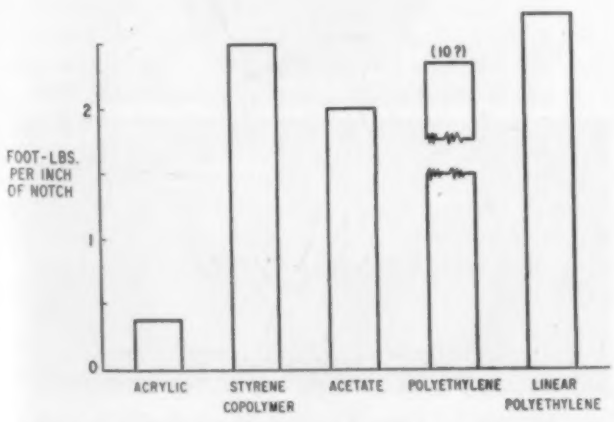

Fig. 1. Izod impact strengths of formable plastic sheets.

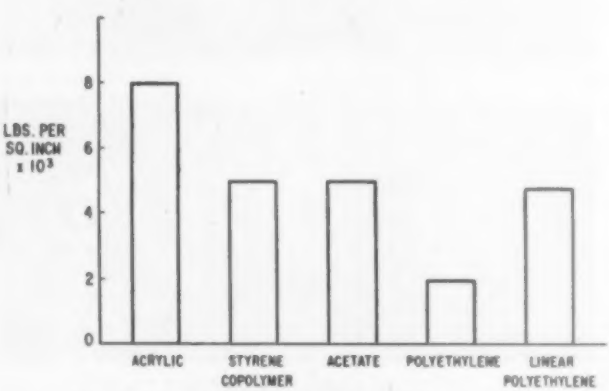

Fig. 2. Tensile strengths of formable plastic sheets.

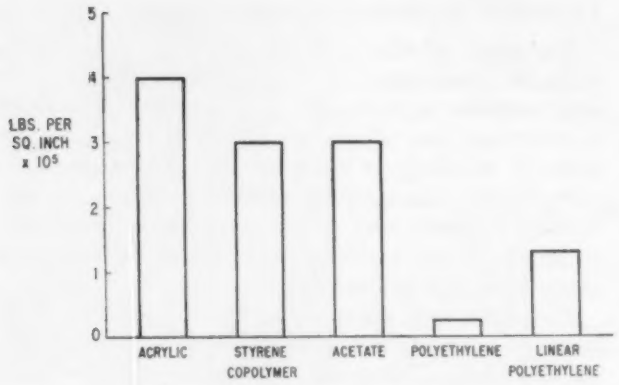

Fig. 3. Tensile modulus values of formable plastic sheets.

on needled batt gave very regular but rough surfaces; while the surfaces from the needled batt were the least regular. The objects shown in Figure 4 were formed into a cylindrical cavity. Circular samples were clamped to the rim of the cylinder, heated from above by a radiant unit, and formed at roughly 160° C. This system was used to provide fairly accurate data on degrees of formability by measuring the volumes of the formed pieces.

Effect of Fiber Content

The ease of formability of acrylic sheets decreased with increasing "Orlon" fiber content in the sheets. With fiber loadings of 25% or less, the formability of the reinforced sheets was similar to that of commercial cast acrylic sheet. Laminates containing more than 25% "Orlon" acrylic fiber were too stiff for appreciable forming with the 15 psi. pressure of the vacuum method. At these higher fiber loadings, forming by means of air pressure or even matched molds is recommended.

Figure 5 shows the smooth, polished surfaces which are achieved by forming in matched metal molds. The blank used to make the smaller bowl was clamped in a frame before being heated and formed. The clamping eliminated the wrinkles which usually occurred when the sheet was allowed to slip freely into the mold. It was even more significant to commercial forming methods that the clamping required elongation of both the plastic and the fiber within it for the sheet to conform to the shape of the mold. Early experimental work has indicated that forming in matched molds is best done with relatively cool molds and at high press speeds. These conditions suggest the use of metal stamping techniques.

Both "Dacron"** polyester fiber and nylon fiber, in the form of needled batts, also were investigated as reinforcements for acrylic sheet. Laminates made with these fibers were not easy to form, but had higher impact strengths than those containing "Orlon". Neither nylon nor "Dacron"-reinforced acylics could be formed to any great depth by simple vacuum techniques. However, sheets containing more than 35% "Dacron" were clamped and formed in a matched metal mold to give articles identical in appearance to the dishes shown in Figure 5. "Dacron" and, to a slightly less extent, nylon needled batts gave laminates having a much higher impact strength than those containing "Orlon" at similar fiber loadings. The same relative effects of these fibers have been noted in the impact strengths of polyester laminates.

Mechanical Properties

Some of the mechanical properties of the reinforced acrylic sheets are given in Figures 6-10. Figure 6 presents a comparison of the notched Izod impact strengths of an acrylic control, a high-impact styrene copolymer, and reinforced acrylic sheets containing about 25% fiber. These data emphasize the superiority of "Dacron" and nylon in the preparation of very high-

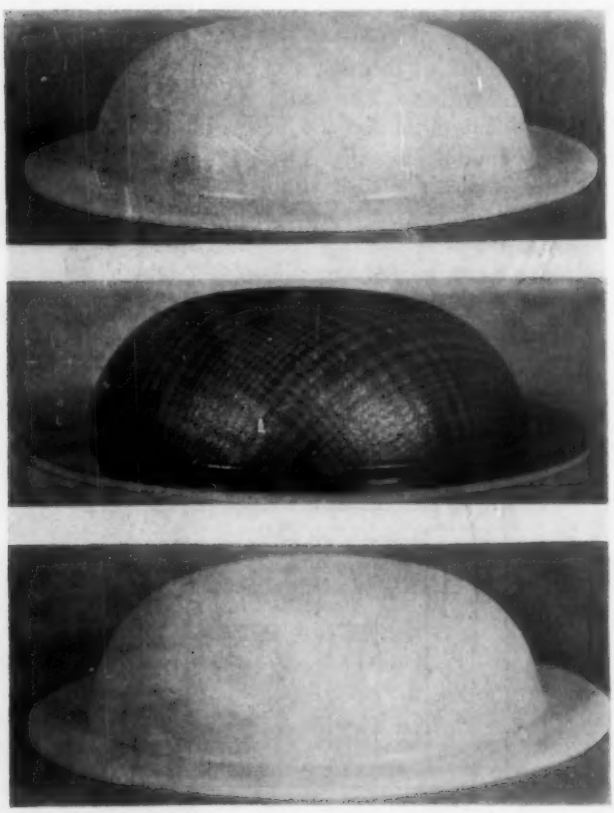

Fig. 4. Vacuum-formed "Orlon"-reinforced acrylic sheets with needled bat *(top)*, woven fabric *(center)*, and paper *(bottom)*.

Fig. 5. "Orlon"-reinforced acrylic sheets formed in matched metal molds; *(top)* clamped blank, and *(bottom)* free blank.

impact laminates. The relation of fiber concentration for "Dacron" and "Orlon" to notched Izod impact strength is shown in Figure 7. The greater toughness of "Dacron"-reinforced sheets at all fiber loadings is obvious.

A comparison of tensile strengths is given in Figure 8. The reinforced acrylics are seen to be stronger than the styrene copolymer, but somewhat below the level of an acrylic control. Tensile strengths at 100° C. are compared to those at 25° C. in Figure 9. The reinforced sheets are actually stronger at the higher temperature, and indicated a greater thermal stability of tensile properties.

Initial tensile moduli data are summarized in Figure 10. The moderate increases in tensile and flexural moduli were always observed with synthetic fiber reinforcement, particularly with "Orlon" and "Dacron".

Dimensional Stability

The effect of "Orlon" reinforcement upon the dimensional stability of acrylic sheet at elevated temperatures was shown by a test where test bars one-half inch wide by five inches long were laid across the lips of a tray with a 3¼-in span, and left in an oven for 30 minutes at 125° C. This temperature was sufficient to cause appreciable drooping of the control bar, with much less effect on the reinforced compositions. Bars out from general purpose polystyrene, high-impact styrene copolymer, and linear polyethlene were almost shapeless after similar exposure at only 100° C.

Craze Resistance

The craze-resistance of reinforced acrylic sheet was determined by attaching a weight to one end of a half-inch wide test bar, and supporting the other end so that the stress was concentrated over a fulcrum. The area of the bar over the sulcrum was kept wet with a mixture of 5% toluene in "2B" denatured alcohol. The results of this test are presented in Table 1, wherein even 15% of "Orlon" is shown to cause a marked increase in craze-resistance.

Potential Applications

One attractive application of reinforced acrylic sheets was in the preparation of overlays having the same distinctive properties as the formable sheets. Surfaces with unusual resistances to weathering, crazing, and impact were obtained in one-step laminations using "Orlon" needled batt, the catalyzed acrylic solution, and practically any base material. No adhesive was necessary. Substrates such as plywood, cinder block, sheet metal, and formed cellulose acetate were used successfully. The overlayed wood specimens could be nailed, sawed, and drilled without delamination, cracking of the overlay, or other damage. The laminates to metal were heated and bent through an angle of 135° without delamination or cracking. Common metal stamping procedures undoubtedly would be applicable to such laminates.

Colored, opaque, or translucent fiber-reinforced acrylic sheets, as well as overlays, were made by stirring in colors-in-oil or ball-milling dry fillers into the acrylic solutions. Certain pigments had harmful effects

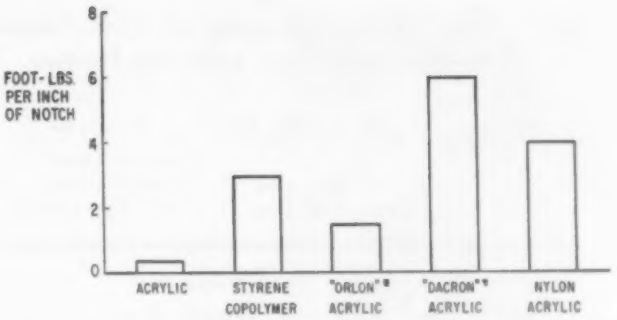

Fig. 6. Izod impact strength with 25% fiber of formable reinforced plastic sheets.

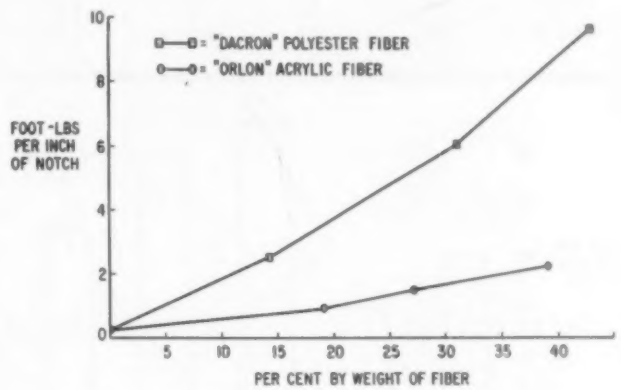

Fig. 7. Effect of fiber content on Izod impact strength of acrylic sheet.

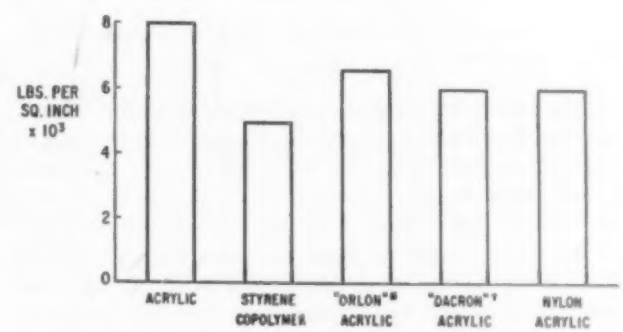

Fig. 8. Tensile strength with 25% fiber of formable reinforced plastic sheets.

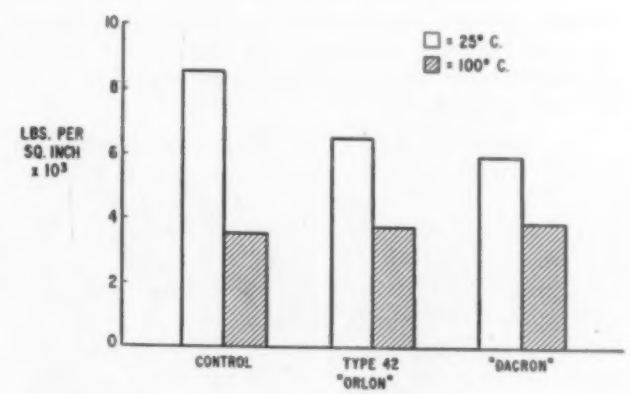

Fig. 9. Effect of temperature on tensile strengths at 25% fiber of reinforced acrylic sheets.

Table 1. Stress-Corrosion Cracking of "Orlon"-Reinforced Acrylic Sheet under 2,000 Psi. Pressure.

"Orlon" Content, Wt. %	Time to Break, Min.	Appearance
0	½	Severly crazed.
15	Unbroken after 7	Slightly crazed.
38	Unbroken after 7	Very slight crazing

Table 2. Electrical Properties of "Orlon"-Reinforced Acrylic Sheet.

Frequency, Cycles/Sec.	Dielectric Constant		Dissipation Factor, $\times 10^{-2}$	
	Control	17% "Orlon"	Control	17% "Orlon"
10^2	3.6	3.8	5.3	6.6
10^6	2.9	3.0	2.0	2.2
8.6×10^8	2.6	2.8	0.43	0.72

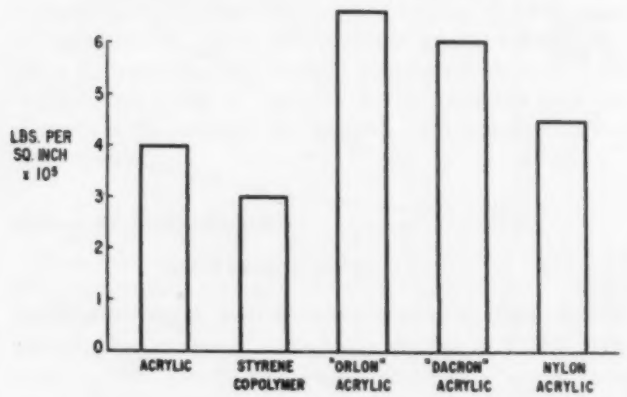

Fig. 10. Tensile modulus values at 25% fiber of formable reinforced plastic sheets.

on the otherwise excellent weatherability of the "Orlon" acrylic fiber-reinforced sheets. Sample panels containing anatase titanium oxide were exposed for 500 hours in an Atlas Weather-Ometer, while panels made with ultramarine blue were exposed outside for one year in Northern Delaware. Both materials suffered marked surface deterioration (more severe with the anatase-containing piece) and lowered Izod impact strengths.

Crome yellow, rutile titanium oxide, and iron oxide pigments (1-15% by weight) had no apparent effect on the stability of "Orlon"-reinforced laminates in the Weather-Ometer. After more than 500 hours in the Weather-Ometer, unpigmented acrylic panels containing 25% "Dacron" polyester fiber and "Orlon" acrylic fiber apparently were unaffected with regard to color and surface gloss.

The results of certain electrical measurements on "Orlon"-reinforced sheets are summarized in Table 2. Both the dielectric constants and dissipation factors were measured over a wide range of frequencies. The data, as presented for 100 cycles, one megacycle, and 8,600 megacycles, showed that the "Orlon" reinforcement caused only slight increases in both properties. For electrical applications, these data were significant mainly because the pattern of the variations of dielectric and dissipation values with frequency was not altered by the reinforcing fiber.

—THE END

Effect of Blow-Up Ratio on Properties of Polyethylene Blown Film

(*Continued from page 713*)

Conclusions

To obtain a good balance of tensile, elongation, and tear properties in both machine and transverse directions, a blow ratio of approximately 3.5:1 is indicated. This blow ratio gives a satisfactory, but not maximum, impact strength. The blow ratio of 3.5:1 is in the range desirable for obtaining minimum consistent thickness.

It was clearly shown that properties of the film in one direction increase with an increase in blow-up ratio, while properties in the other direction decrease. The type of resin, specifically its density, has as great an effect on film properties as does the blow-up ratio.

Acknowledgements

The author gratefully acknowledges the assistance of K. A. Kaufmann and John F. Morris for their help in correlation and interpretation of the data, and the aid of all other Plastics Laboratory personnel. —THE END

Automatic Pellet Deflashing of Molding with Metal-Pin Inserts

(*Continued from page 715*)

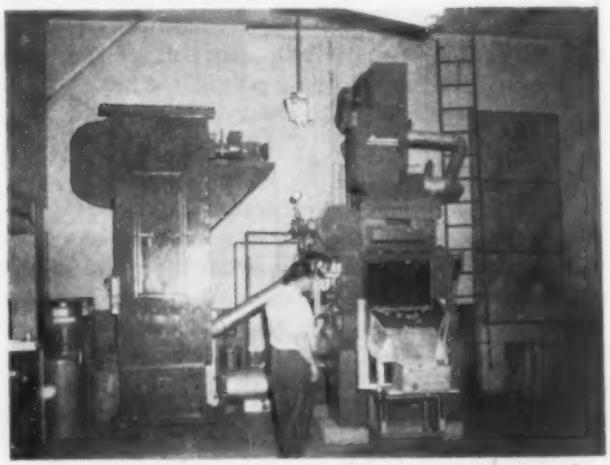

Photo courtesy of Wheelabrator Corp.

Fig. 3. Automatic pellet deflasher at H. H. Buggie, Inc., shown automatically discharging a load of molding after deflashing. At left is Wheelabrator dust collector that keeps deflashing compartment under suction and parts dust free.

Photo courtesy of Wheelabrator Corp.

Fig. 4. Close-up view of deflashing compartment.

B. B. PUSEY, *Development Department, Bakelite Co., Bound Brook, N. J.*

Flexural Fatigue Strengths of Reinforced Thermosetting Laminates

Results are given of tests of 32 polyester, phenolic, and epoxy laminates to show effects of resins, reinforcements, interface reagents, and fillers.

DURING the last year or two, design engineers have been presented with some of their first-long-term property data as it applies to plastic structural components. Various groups that are concerned with these time-consuming investigations have published worthy articles concerning the property of fatigue.

While this information concerning the effects of fatigue stressing in plastics is available, few of the articles directly assist the design engineer in selecting the unique laminating ingredients for his specific end-product. It is the purpose of this paper to present such design information as obtained by our laboratories in the fatigue strength evaluation of reinforced thermosetting plastics. As shown in Table 1, 32 polyester, phenolic, and epoxy laminates were evaluated to study the fatigue strengths offered by:

(1) Standard Bakelite polyesters, epoxies, and phenolic laminating resins;
(2) Fibrous glass woven fabric, fibrous glass random mat, and paper reinforcements;
(3) Chrome complex, silane, and Linde Y-1100 resin-reinforcement interface reagents;
(4) Calcium carbonate and aluminum silicate resin fillers.

It is believed that the data to be presented on these influencing factors will contribute to the effectiveness of designs incorporating reinforced plastics.

The Problem

The standard mechanical tests (tensile, flexural, etc.) evaluate the ability of a material to support a stress which is brought to a maximum in from 2-3 minutes in air at 23° C. Such tests are useful in providing an initial idea of the "strength" of a material, but these tests do not reproduce many conditions of use, and may give a misleading estimate of structural strength. For example, the fenders on a moving automobile are subjected to vibration or varying stresses which the standard tests do not reproduce. Under live loading conditions, many materials fracture or break when stressed at values considerably below their short-time strengths. The fatigue test, therefore, has been designed to evaluate these less-apparent, time-dependent phenomena.

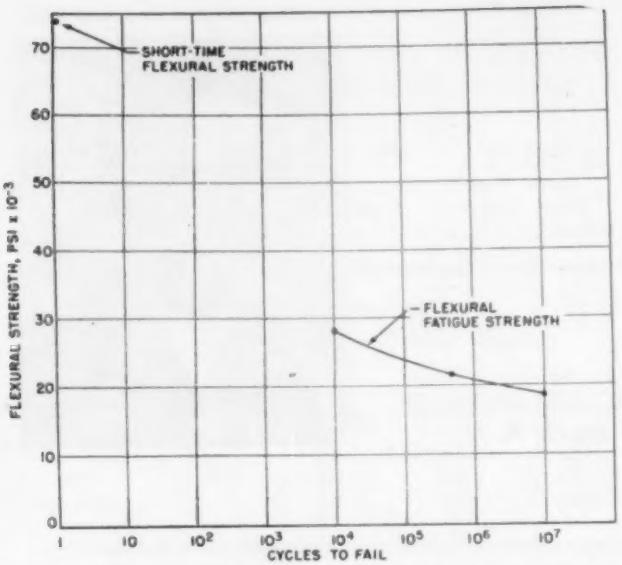

Fig. 1. Comparison of short-time flexural and fatigue strength.

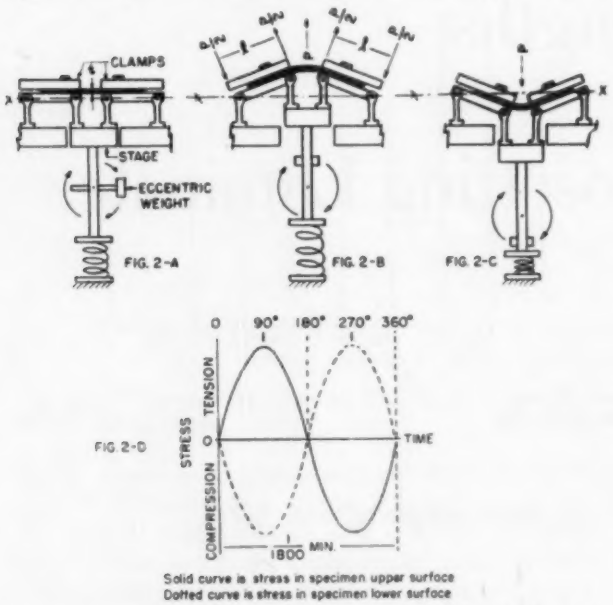

Fig. 2. Components of the fatigue test: A—Assembly at the instant that the eccentric weight lies in a horizontal plane; B—Assembly when the eccentric weight is vertically above its center of rotation; C—Assembly when the weight is vertically below its center of rotation; and D—Plot of stress changes in specimen with weight rotation.

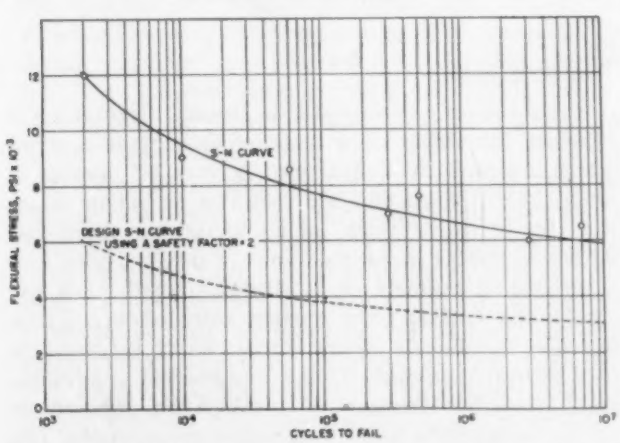

Fig. 3. Typical S-N curve of flexural fatigue stress vs. log of cycles to fail.

An illustration of the relationship between the short-time flexural strength and the flexural fatigue strength of a laminate is presented in Figure 1. The data for the short-time tests (plotted at one cycle) indicates a flexural strength of 74,000 psi. The fatigue curve, on the other hand, indicates that the material has a fatigue strength of 28,000 psi. at 10,000 cycles, 21,700 psi. at 500,000 cycles, and 18,800 psi. at 10,000,000 cycles. This fatigue strength continues to decrease with increasing "service life." Figure 1 indicates the magnitude of difference to be found between the short-time strength and the fatigue strength of many reinforced plastic laminates.

Test Methods

The purpose of any mechanical laboratory evaluation is to predict the structural performance of a material from practical laboratory tests. Since short-time tests do not provide sufficient structural information, they must be accompanied by tests that are more conclusive with respect to the data they present. Fatigue tests, without a doubt, are more effective in this regard where (1) The criterion of failure is rupture, and (2) Applied stresses are essentially varying. The curve of Figure 1 shows the actual maximum stress-bearing capabilities of a laminate for a service life of 10^6 cycles of reversed bending stress.

To be effective, fatigue tests must be designed to extend over a sufficient period of time so as to characterize the materials. In this regard, tests that measure fatigue stress-bearing capabilities to a service life of ten million cycles are frequently used. The maximum stresses obtained with these ten-million cycle tests then is used to compare the strengths of materials. Although most structures are designed to live longer than the ten-million cycle limit, as a rule it is not economically feasible to test the service lives of materials for longer periods. Thus, the ten-million cycle test represents a convenient source of quantitative information that may be used in practical comparisons of materials for structural strength.

The stress that a material can support for ten-million cycles cannot be measured directly by using only one specimen. Instead, a series of specimens must be tested over a range of stresses, beginning with one specimen tested at a relatively high stress, and following with specimens tested at successively lower stresses. The specimen tested at the highest stress fails in a relatively short time, while those specimens tested at lower stresses fail at longer periods of time.

The fatigue test, as it was performed on the various laminates of this investigation, is illustrated by the sketches in Figure 2. The essential portion of the apparatus is the reciprocating stage, which is driven vertically by the rotation of the motor-driven eccentric weight. The force, P, is governed by the radial setting of the weight. A test specimen is firmly clamped in position so as to resist, in bending, the motion of the stage.

Figure 2a shows the assembly at the instant that the eccentric weight lies in a horizontal plane with its center of rotation while operating at 1,800 rpm. In this position, the specimen is supporting no stress. Figure 2b illustrates the assembly at the instant that the eccen-

Table I. Laminates Tested in Fatigue Investigation.

Laminate Number	Resin	Type	Reinforcement	Interface Reagent
1	Polyester	PLL-5147	Owens-Corning 181-136 Glass Fabric	Silane
2	"	PLL-5193	" " " " " "	"
3	"	PLL-4264	" " " " " "	"
4	"	PLL-5147	" " 2-oz. T-19 Random Glass Mat	Chrome Complex
5	"	PLL-5193	" " " " " " "	" "
6	"	PLL-4264	" " " " " " "	" "
7	"	90/10 PLL-5193/ PLL-3136	" " " " " " "	" "
8	"	80/20 PLL-5193/ PLL-4264	" " " " " " "	" "
9	"	88.5/11.5 PLL-5193/Styrene	" " " " " " "	" "
10	"	90/10 PLL-5193/ PLL-3136	G. P. "Garan" Random Mat	Silane
11	"	" "	O-C T-19 Random Glass Mat (resin contained no filler)	Chrome Complex
12	"	" "	O-C T-19 Random Glass Mat (resin contained 33%, by wt., of Surfex MM filler)	" "
13	"	" "	O-C T-19 Random Glass Mat (resin contained 33%, by wt., of ASP-400 filler)	" "
14	"	" "	Three plies G. P. "Garan" Mat plus one ply Glass Veil	Silane
15	Epoxy	ERL-3794/4,4'MDA	O-C 181-"Volan A" Glass Fabric	Chrome Complex
16	"	ERL-3794/BR-18803	" " " " " "	" "
17	"	ERL-3794/BR-18812	" " " " " "	" "
18	"	ERL-2774/BR-18812	" " " " " "	" "
19	"	ERLA-3001	" " " " " "	" "
20	"	" "	O-C 1½-oz. T-16 Random Glass Mat	" "
21	"	ERL-3794-4,4'MDA	" " " " " "	" "
22	Phenolic	100/4 BLL-3085/ Hexa Solution	O-C 181-"Volan A" Glass Fabric	" "
23	"	" "	" " " " " " (lam. contained 39.6% resin, by wt.)	" "
24	"	" "	" " " " " " (lam. contained 29% resin, by wt.)	Chrome Complex plus Linde Y-1100
25	"	100/22.5 BLSA-8946/Hexa Soln.	(lam. contained 29.5% resin, by wt.)	Chrome Complex
26	"	" " "	" " " " "	" "
27	"	100/3 BLSA-3005/ Hexa Solution	lam. contained 38% resin, by wt.) " " " "	Chrome Complex plus Linde Y-1100
28	"	BRPA-5005 Natural	Bigelow-Sanford #1001 Woven Glass Mat	Chrome Complex
29	"	3/1 BRZA-7717/ BRZA-1302	O-C ¾-oz. Random Glass Mat	" "
30	"	BRZ-7541	N.E.M.A. Grade X paper	None
31	"	BV-16739	" " " "	"
32	"	BLS-2700	" " " "	"

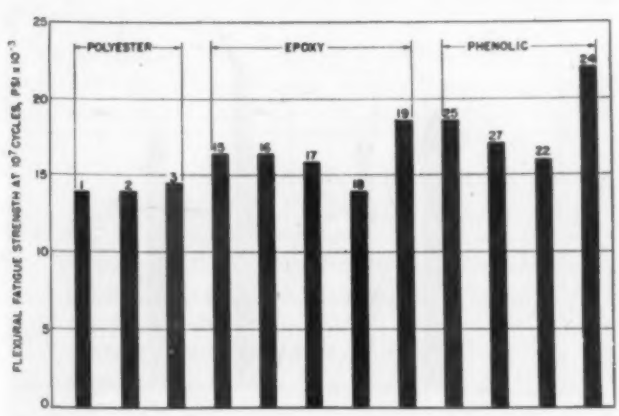

Fig. 4. Flexural Fatigue Strengths at 10-million cycles of thermosetting resins reinforced with 181 glass fabric.

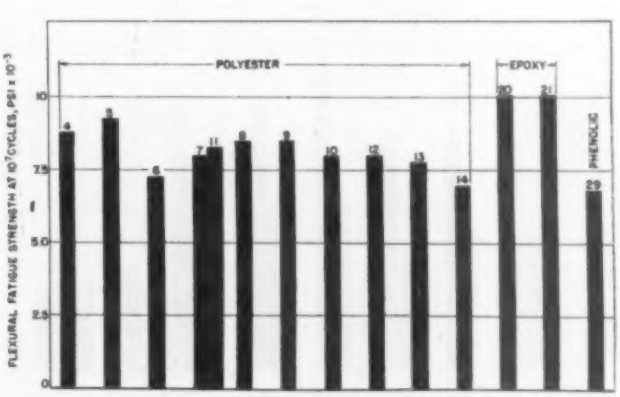

Fig. 5. Flexural fatigue strengths at 10-million cycles of thermosetting resins reinforced with glass random mat.

tric weight is vertically above its center of rotation. The force, P, applies two equal and opposite couples at the ends of the specimen. It can be shown that the free length of the specimen between the clamps is essentially in pure bending (without shear), and is resisting a bending moment equal to PL/2 inch-pounds. In this position, the stress in the upper and lower surfaces of the specimen is as shown at 90° in Figure 2d. Figure 2c illustrates the assembly at the instant that the eccentric weight is vertically below its center of rotation. In this position, the upper and lower surfaces of the specimen are stressed as shown at 270° in Figure 2d.

In running these tests, a record of specimen failures is kept on four-cycle semi-log graph paper which extends between one thousand and ten million cycles. Experimental points, entered on the graph as specimens fail, serve as a guide in selecting succeeding stresses to be applied. Such a plot is generally identified as a "Stress-Number of Cycles Curve" or S-N curve.

Typical data from which S-N curves were drawn for this work are shown as points on Figure 3, where the stress applied to each specimen is plotted against the log of the number of cycles to fail. One specimen tested at a flexural stress of 12,000 psi. failed at 2,000 cycles; a second specimen tested at 9,000 psi. failed at 10,000 cycles; etc. Finally, an averaging curve is drawn through the seven points (as shown by the solid curve in Figure 3) which intercepts the ten-million cycle life at 6,000 psi.

The solid S-N curve represents the stress which must not be exceeded for any fatigue life between two thousand and ten million cycles. For example, flexural fatigue stresses in excess of 9,500 psi. may not be applied to this material if the fatigue life of a component is to be ten thousand cycles.

Although this S-N curve is of interest in comparing materials, it serves only as a base-line for the computations of the design engineer. Factors, such as: batch-to-batch variability of resin, glass, and sizing; local variability of resin cure, resin content, glass fiber orientation, glass fiber content, and sizing content within a piece; and piece-to-piece variability, would cause the design engineer to assign a generous safety factor in translating experimental data into working stresses for field-molded parts.

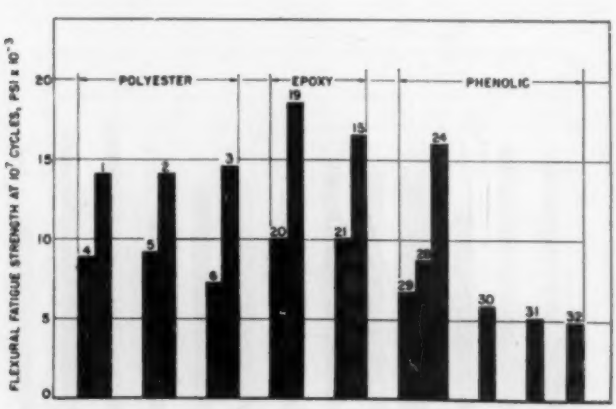

Fig. 6. Effect of reinforcement on flexural fatigue strengths at 10-million cycles of thermosetting resins reinforced with glass fabric, glass mat, and paper.

Figure 3 also shows a design curve drawn according to a safety factor of two (see dotted curve). Accepting the recommendations of this curve for design work would be preferable to accepting those of the solid S-N curve.

Some materials, for example structural steel, exhibit S-N curves in which S decreases initially with increasing N, then levels out to constant values of S with increasing N. Such stresses are known as "endurance stresses" and can be considered design stresses which permit the computation of working stresses for the materials. Endurance stresses have not been found for fibrous glass-reinforced thermosetting laminates out to a life of 10^8 cycles. An S-N curve, therefore, must be consulted for the design of glass-reinforced plastics components, instead of a single value of stress.

Since, in this work, materials have been tested to permit the determination of the rupture stress at ten million cycles, this rupture stress is used here as a basis of comparing materials. It warrants repeating, however, that for the laminates reported here the S-N curve must be referred to in all designs, and that no single value of stress will suffice for general design work.

Discussion of Results

Effect of Resins

The bar graphs of Figure 4 indicate the greatest flexural fatigue stress which the laminated glass fabric supported for a fatigue life of ten million cycles. A comparison of these data indicates the following:

(1) Compared in groups, the polyester laminates offer the lowest fatigue strengths, while the phenolics offer the highest strengths.

(2) The choice of resins appeared significant within the epoxy and phenolic groups, while the choice of resin within the polyester group had no significant effect.

(3) The choice of hardener within the epoxy group had no significant effect.

(4) Refinishing the 181-"Volan A" glass fabric with Linde Y-1100 reinforcement interface reagent offered a significant increase in fatigue strength for laminate No. 24.

The bar graphs of Figure 5 indicate the greatest flexural fatigue stresses which the laminates reinforced with glass random mat supported for ten million cycles.

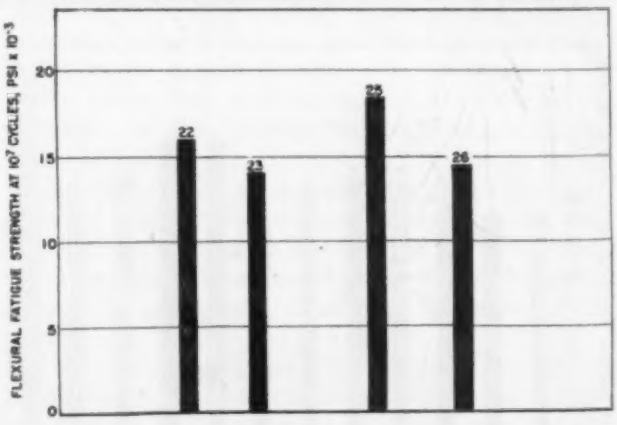

Fig. 7. Effect of resin content on flexural fatigue strengths at 10-million cycles of two phenolic resins reinforced with O-C 181-Volan "A" glass fabric.

Table 2. Flexural and Flexural Fatigue Strengths of Glass-Reinforced Laminates.

Resin	Type	Reinforcement	Conventional Flexural Strength, Psi.	1,000-Hr. Flexural Strength, Psi.	10^7 Cycle Flexural Fatigue Strength, Psi.
Polyester	PLL-5147	O-C 181-136 Glass Fabric	50,000	36,000	14,000
"	PLL-5193	" " " " "	60,500	45,000	14,000
"	PLL-4264	" " " " "	60,500	35,500	14,400
"	PLL-5147	O-C T-19 Random Glass Mat	36,300	18,500	8,800
"	PLL-5193	" " " " "	33,000	22,000	9,300
"	PLL-4264	" " " " "	39,300	19,000	7,200
Epoxy	ERL-2774/4,4'MDA	O-C 181-"Volan A" Glass Fabric	64,600	44,000*	16,500
"	ERLA-3001	" " " " " "	74,200	47,000*	18,500
Phenolic	BLSA-8946/Hexa Soln.	" " " " " "	83,000	47,000*	18,500
"	BLL-3085/Hexa Soln.	" " " " " "	47,000	47,000*	16,000

*Determined in water at room temperature.

A comparison of these data indicates the following:

(1) The epoxy laminates offered the highest strengths.

(2) Laminate No. 5 bonded with PLL-5193 offered the highest fatigue strength within the polyester group; laminate No. 6 bonded with PLL-4264 offered the lowest strength.

(3) The reproducibility of the evaluation system appears good. The data for laminates 7 and 11 were determined for two panels which were fabricated and tested several months apart.

(4) Adding either PLL-3136, PLL-4264, or monomeric styrene to PLL-5193 produced laminates 7-9 which were similar in strength but all were lower than unmodified PLL-5193 (laminate No. 5).

(5) The silane finished mat offered the same fatigue strength at 10^7 cycles as did the chrome-complex finished mat (laminates 7 and 10).

(6) The addition of 33% Surfex MM* (calcium carbonate) or 33% ASP-400** (aluminum silicate) fillers to a polyester resin had no appreciable effect on fatigue strengths of laminates 12 and 13, respectively.

(7) The addition of a glass veil *** surface sheet reduced the strength of a polyester laminate (laminates 10 and 14).

(8) The one phenolic laminate that was tested, No. 29, offered the lowest fatigue strength of this series.

Effect of Reinforcements

As is evident from Figure 6, laminates reinforced with 181 glass fabric offer higher fatigue strengths than laminates reinforced with glass random mat or paper.

From the phenolic series, the Bigelow-Sanford woven mat appears superior to the glass random mat. However, the resins used throughout this comparison were not the same, and a decision on the relative merits of both reinforcements is not recommended based wholly upon the data given here.

The strengths for the paper reinforced laminates are the lowest for the series.

*Product of Diamond Alkali Co., Cleveland, O.
**Product of Edgar Brothers, Metuchen, N.J.
***The glass veil used here is a thin sheet (about 5 mils thick) of glass random mat, and is applied as a surface sheet to improve the surface appearance.

Effect of Resin Content

The bar graphs of Figure 7 indicate the effect of resin-richness on the fatigue strengths of glass fabric-reinforced phenolic laminates. It is apparent that increasing resin content in these laminates resulted in a decrease of fatigue strength.

An increase in resin content of 41% for the BLL-3085/Hexa Solution laminate (Laminates 22 and 23) resulted in a decrease of fatigue strength of 13%. An increase in resin content of 29% for the BLSA-8946/Hexa Solution reduced the fatigue strength by 22% (Laminates 25 and 26).

Polyester-Glass Mat Laminate

Data determined for five similar polyester-glass mat laminates are shown in Figure 8. An envelope has been drawn to include all but one of the 45 specimens tested, and the stress range of the envelope indicates specimen-to-specimen and panel-to-panel variabilities encountered in fatigue testing of glass random mat laminates.

It is clear that these variables influence precise estimates of the rupture stress for a given fatigue life, and the fatigue life at a given rupture stress.

A large amount of test data, therefore, must be collected and analyzed by statistical methods to deter-

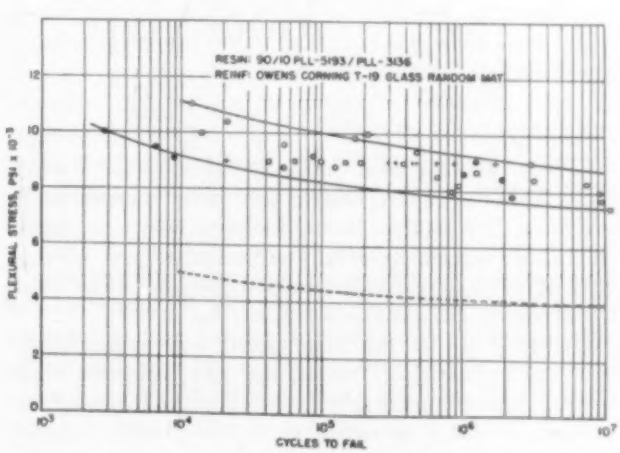

Fig. 8. Flexural fatigue stress vs. cycles to fail for five polyester laminates made with glass random mat.

mine differences in fatigue stress-bearing ability between similar laminates. Industry recognition of this fact has encouraged the American Society for Testing Materials to conduct studies of variability in fatigue data (see items 5, 6, and 8 of Bibliography).

The data of Figure 7 would offer great comfort to the design engineer. If the material being studied offered the chemical and other mechanical properties required, he would establish a design S-N curve based upon a safety factor, and continue through his design study. The dashed S-N curve of Figure 8 would offer a basis for sound design from fatigue considerations.

For convenience, data from three flexural tests are shown in Table 2 for 10 laminates. This table permits a rapid comparison of the short-time, long-time, and fatigue strengths. It is interesting to note that the average 10^7-cycle flexural fatigue strength for all laminates reinforced with O.C. 181 glass fabric is 24% (range: 21-28%) of the average conventional flexural strength. Essentially the same relationship is obtained for the laminates reinforced with O.C. T-19 random glass mat.

Acknowledgment

The author wishes to acknowledge the cooperation of his associates at the development laboratories of Bakelite Co. in Bloomfield and Bound Brook, N.J.

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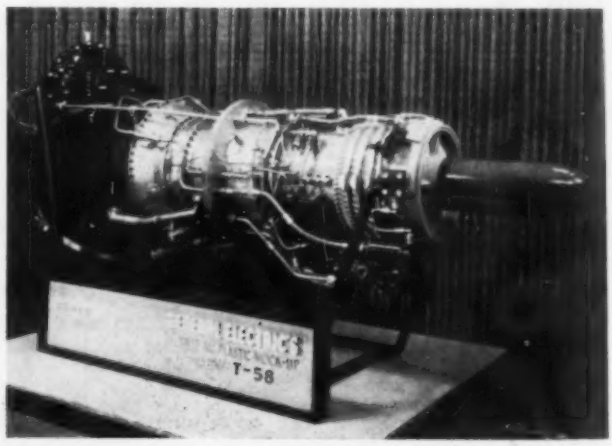
—THE END

Reinforced Epoxy Mock-Up



Reinforced plastic mock-up of GE's T58 turboshaft engine.

A full-sized plastic mock-up of General Electric Co's T58 turboshaft engine has been completed by Atkins & Merrill, Inc., South Sudbury, Mass., producers of industrial-scale models. The prototype will be used by aircraft manufacturers in planning airframe clearances and installation connections.

Believed to be the first model employing fibrous glass-reinforced epoxy resins, the T58 mock-up would have required considerably more time and expenditure if made of wood or metal. In addition, plastic models offer excellent dimensional stability while keeping weight to a minimum.

Wood masters are built directly from blueprints, or wood mock-ups can be furnished by the customer. Surface must be finished to a high luster, as in the case of any plastic molding operation. Metals are used for reproducing such surfaces as embossed name plates and difficult contours.

An article with many undercuts and complex contours usually requires a flexible female mold, consisting of a rigid outer shell and flexible inner casing. The latter is stripped off after lay-up, leaving complete undercut details.

—THE END

Compression and Transfer Molding

The current and future status of the phenolic molding industry.

Edited by:
JOHN H. WOODRUFF *President,*
Auburn Button Works, Inc., Auburn, N. Y.

The SPI sponsored a discussion in Syracuse, N. Y., August 1st, on the current and future status of the phenolic molding industry. The meeting was arranged at request of E. M. Irish, Manager of Phenolic Products Sales, General Electric Co., and was attended by representatives of the major phenolic materials manufacturers and a few molders.

An attempt was made to determine whether there exists in the phenolic industry a common problem on which the industry as a whole could or should take action. The problem was stated in these exact terms, and it was agreed generally that it existed as stated:

(1) The market for phenolic molded parts has not grown in total volume in 10 years.

(2) This lack of growth has occurred in an atmosphere that has been extremely favorable to the over-all growth of plastics materials.

(3) As a result, the phenolics portion of the market has dropped from approximately 40% in 1946 to about 10-12% in 1956.

(4) The natural consequence has been to attempt to retain business in both phenolic moldings and compounds on a price basis during inflationary times.

(5) This stiff competition has taken two forms: (a) With thermoplastics which have shown basically better economies due to faster cycles and end-user demand for color; and (b) Within the compression molding industry through an attempt by the molders to maintain or increase their share of the dwindling market.

(6) The result has been that the phenolics industry, which formerly led all plastics, has lost the vitality, progress, and leadership that comes from: (a) Modernization for improved processes and lower costs; (b) Research and development for growth in new markets and applications; and (c) Expansion of facilities.

On the plus side of the ledger, however, a new premise was discussed; namely, that there has been a major change in the end-use patterns of the industry. No longer are phenolics thought of as "general-purpose" materials to be considered as the potentially economic compounds to be applied in all applications. Instead, the industry recognizes that phenolics are "special purpose" materials that render economies offered by no other material. These special properties are heat resistance, dimensional stability, and resistance to creep under stress.

It was developed, therefore, that phenolics make a real contribution to the national economy on the basis of their intrinsic value as engineering materials. Secondly, this value ought to be enhanced or defined better to the end-user, the customer for phenolic molded parts.

Other phases of discussion turned to the revitalization of market growth in phenolic moldings through cost reduction. Of wide significance is the work now being done on new concepts in molding methods and processes whereby cure cycles of standard phenolics can be reduced as much as 70%. Also, as was pointed out in our last column by N. W. Oberle, automatic presses can show substantial cost reductions on long-running jobs.

The net result of the Syracuse discussion was that it is worthwhile and timely to consider a broad approach to the status of phenolics. There was considerable feeling that some action is necessary to provide leadership in this segment of the industry for the long term.

I am indebted to Ned Irish for his notes on the Syracuse meeting, since I was unable to attend.

—THE END

Edited by:
HARRY T. DOUGLAS
Executive Vice President
Lunn Laminates, Inc.
Huntington Station, N. Y.

Reinforced Plastics

What price standards?

In recent months, steps have been taken by several groups within the Reinforced Plastics Division of the Society of Plastics Industry, Inc., to establish quality standards. This is encouraging, and should pave the way for a firmer future for the industry as a whole.

The leader in this movement is the electrical field, where workable standards have been in use for some time. Such fields, however, as flat and corrugated panels, plumbing fixtures, and boats are still trying to develop standards for their respective products.

This is no easy accomplishment. Well-known industries such as steel and aluminum took many years to reach the level of standardization which now exists. The men who are struggling to overcome the many obstacles in the way of standardization certainly deserve a pat on the back.

A good deal of the impetus behind the actions of these various groups who are trying for standardization comes, of course, from Uncle Sam. The men who buy for the government must understand and define requirements clearly for every purchase, if they are to buy wisely and avoid criticism from unsuccessful contenders in government work.

It is relatively easy for a buyer to assemble a detailed list of characteristics which a product must have. It is quite another thing for him to determine how many extra dollars are represented by each stipulation he adds to his requirements, as well as each manufacturing difficulty he causes by specifying difficult-to-obtain characteristics. The logical sources of such specification, therefore, are the manufacturers who must set up standards based on what they can attain with varying degrees of economy.

Quality standards are good for bidders and bids can be presented intelligently with a reasonable assurance of the quality. This is a tremendous advantage to everyone, since these standards will tend to eliminate the deliberate underbidder, the unscrupulous overbidder, and the poor guesser who loses his shirt on the job. The adoption of quality standards also will attract larger customers to the field.

For example, there would be more business from the aircraft manufacturers who demand that the products live up to very strict requirements. Other manufacturers would be encouraged to "switch" to reinforced plastics, including those who had been disappointed in the past by receiving a poor reinforced-plastic part.

Quality standards should bring about fairer pricing. To produce a quality part, the molder cannot substitute inferior materials and get away with it. Basically, he must use the same material as anyone else.

The molding technique would be established beforehand, since the physical properties of the finished part predetermine what method is applicable. It has been said that some molders who buy reinforced plastics parts and also mold their own have a "double standard." They will accept parts of their own manufacture, the quality of which they would not accept from another molder. This practice, if it exists, would be eliminated with the adoption of uniform standards.

Finally, while the adoption of uniform standards is a wonderful thing, it must be enforced or lose its potency. It is hoped that the various committees will be able to reach an agreement on production standards, perpetually police them, reward those who conform, and penalize those who do not.

—THE END

Edited by:
ERNEST J. CSASZAR
Vice President,
Eagle Tool & Machine Co., Hillside, N. J.

Mold Making and Tooling

Materials and methods of mold cavity construction

Whenever a contract for a mold is placed with a moldmaker, a decision must be made somewhere along the line as to the method of construction to be used on the mold components. These mold parts (cavities, forces, and the like), usually have a certain complexity as to shape or form. The moldmaker must select a material for the various mold parts, as well as the method of shaping the material to the desired contours and dimensions of the part to be molded.

Among the methods of cavity construction, we can consider: (1) Machining; (2) Hobbing; (3) Beryllium pressure casting; (4) Electroforming; and (5) Investment precision casting (Shaw Process). Of course, there are other methods, too, but these are the most popular. Later in this column, we shall briefly discuss the advantages and limitations of the methods listed above.

First, let us consider some of the factors that have a definite influence on our decision for some definite method or material for cavity construction:

(1) The type of molding to be done. Is the molding procedure to be injection, compression, transfer, or low pressure? This gives us an indication of the types and amounts of stresses to which the mold components will be subjected.

(2) Cost is another factor of construction. Very often, the budget allotted to a molding application limits us to a certain type of mold construction, and prevents use of an alternate or better method. The mere fact that competition enters into almost every molding application may mean that the method of construction and its relative cost can mean the difference between getting or losing a job.

(3) The amount of production anticipated will give us a measure of the required endurance to be built into the mold. For short runs, we often can use methods of construction that would not be suitable for high-speed, long-production runs.

(4) The shape of the part to be molded is another factor to be considered. In some cases, cavity sections are not machinable readily and other means of obtaining the needed contours must be used.

Let us consider some of the methods of construction. Machining directly into a bar of steel or other metal is the most common method. One of the greatest advantages of this type of manufacture is the almost limitless selection of materials that can be used. There are many excellent mold steels with specific properties for high compressive strength, high surface hardness, and high abrasion resistance qualities. The machining of cavities allows us to readily use these steels, whereas we would be limited with other construction methods to specific materials. Furthermore, machining is not limited by size of the mold component. Standard machine shop equipment is suitable for making the most of the cavity cutting requirements, and a minimum of special equipment is required. There are many instances, however, where cavity sections become complex and so located that machining is impractical or very expensive.

Hobbing is very often an answer to this problem. Sections that would be difficult to cut into a cavity often are more readily cut in reverse into a hob and, thus, easily formed into the cavity. The hobbing method offers another advantage in that a difficult machining job is performed only once into the master hob. Then, especially where many cavities are needed, they are reproduced inexpensively by the hobbing process. Hobbing has its limitations, too. The selection of irons or

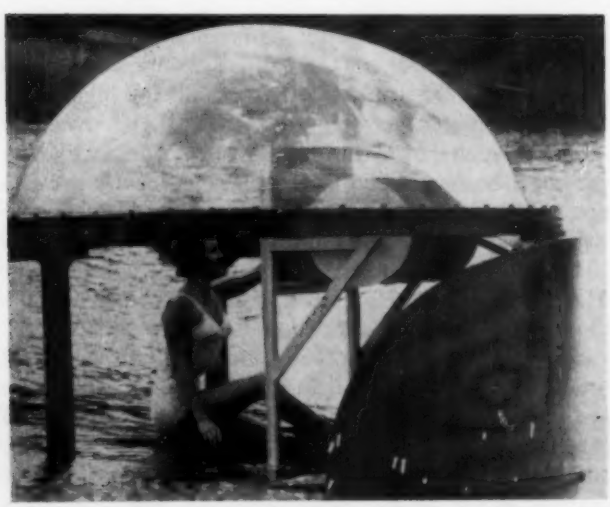
steels which can be hobbed readily is limited. Even the irons and steels that can be used do not develop the compressive strengths of other materials. Another limitation is the fact that the hobbing process employs extremely high pressures applied to the master hob and, therefore, weak or very thin sections of the master hob are subject to breakage during hobbing.

Irregular parting lines can be cast readily along with the cavity shape that could not be done with conventional hobbing. Here again, however, we are limited by the selection of available materials. Beryllium copper does not have sufficient compressive strength for the abuse of compression molding. With this method, furthermore, as with the hobbing method, specialized equipment is required, coupled with a high degree of specialized skill and technique.

Still another method of cavity construction is electroforming. This has the advantage of almost absolute reproduction of the surface of the master hob. Duplication of special textures, such as leather, cloth, etc., is accomplished easily. Furthermore, moldable undercuts can be introduced readily, and very accurate cavity dimensions can be held in relationship to the master. Unlike the hobbing process, however, a separate master is required for each cavity to be produced, but masters can be made of practically any material that can be made to be electrically conductive. There are a number of good methods for readily producing the masters required. Here again, however, we have limitations as to size. Very large cavities have not been made because the special equipment needed is not available in these larger sizes.

Perhaps one of the latest methods of cavity construction is that of investment precision casting (Shaw Process). In this method, a master of the cavity can be made of wood, plaster, plastic, brass, or any similar material. A slurry of a special ceramic material is cast against the master to act as a mold in which to cast the finished cavity. This ceramic mold is fired after it sets and, then, is ready for casting. This method is not limited in the type of material, and practically any castable metal can be used. Many excellent steel alloys are available. Furthermore, the process is rapid and, in many cases, steel cavity castings can be prepared in a matter of days after receipt of the patterns. There are size limitations for the furnaces used to melt the casting metal, and the handling equipment. This method is gaining more wide-spread use and, no doubt, additional advantages will be apparent soon.

—THE END



Above-water view of Plexiglas dome shows relative size of the air pocket.

Plexiglas dome rests above a rock pile 30 feet below water. It serves as an air chamber for members of an underwater ballet team.

Plexiglas Air Chamber

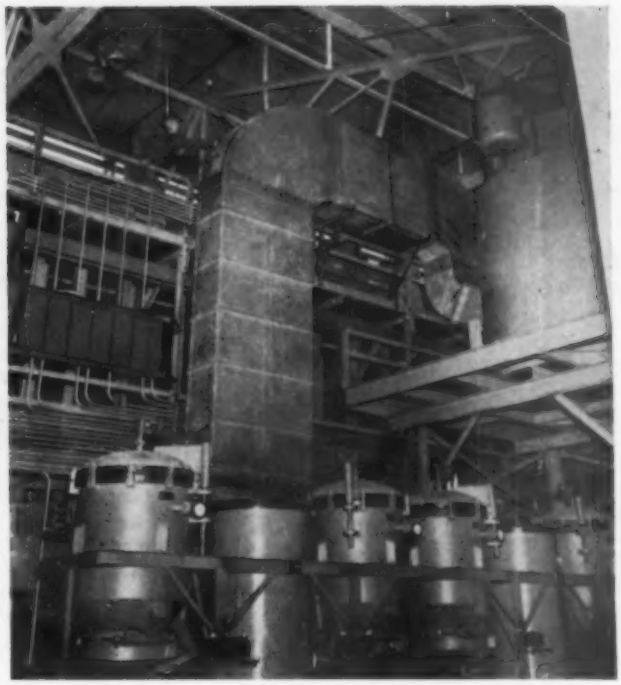
A new use has been found for Plexiglas, Rohm & Haas' acrylic resin. A giant dome, blown from a ½-inch thick, 100- by 200-inch clear sheet of Plexiglas, is serving as a huge air pocket for underwater ballet performers. Installed at the Weeki Wachee "Spring of Mermaids," Brooksville, Fla., the dome enables the swimmers to remain under water for as long as 30 minutes at a time.

The dome is mounted on poles, four feet above a circular steel platform. When the eight-foot platform is submerged, an air compressor pumps clean, filtered air into the dome to form the huge air pocket. It also serves as a decompression chamber for featured performers who dive to depth of 100 feet, and must decompress at the 30-foot level before surfacing.

The platform has a perforated air pipe to provide a curtain of bubbles, which can be turned on and off as desired during the performance. The dome was fabricated by Jacksonville Metal & Plastics Co., Jacksonville, Fla.

—THE END

Close-up reinforced-plastic duct sections, used in the ventilating system of Ford Motor's bumper-plating installation.



Large, fibrous glass-reinforced Hetron duct is resistant to fire and corrosion.

Largest Reinforced-Plastic Duct System

THE two largest rack-type plating machines ever built will plate bumpers for Ford products at the hardware division plant of Ford Motor Co., Monroe, Mich. Installed by Udylite Corp., Detroit, Mich., the straight-line fully-automatic machines are more than 709 feet long and have 80 motor generator sets totaling nearly 800,000 amperes.

The 700,000 cubic foot-per-minute ventilation system incorporates large amounts of plastic ductwork constructed of Hetron 92 polyester resin, reinforced with layers of fiber glass mat. This material, a product of Hooker Electrochemical Co.'s Durez Plastics division, offers both corrosion- and fire-resistance. The installation, actually 22 complete ventilating systems, included reinforced Hetron hoods, drops, plenum chambers, risers, ductwork, fittings, and stacks. Plenums were as long as 42 feet by 14 feet in girth, and the risers measured up to 12 feet.

The history of ductwork material for commercial plating operations is varied and interesting. The earliest ducts were made of unprotected black iron, which soon corroded. Later, acid resistant coatings and rubber linings were used, but these proved expensive and subject to fracture. Rigid PVC was unable to withstand the high heat, and plastisol-coated steel also was subject to fracture and subsequent corrosion.

Hetron-based ductwork proved practically impervious to heat and corrosive attack. Changes and minor repairs can be made on the spot with no risk of further fracture, and with little production loss due to down-time. Since some of the fume elements precipitate solids within the ductwork, it must be inspected and cleaned periodically. The Hetron ductwork has withstood rough scraping with no effect whatsoever on its anti-corrosive characteristics.

Installation costs were reduced appreciably due to the light weight of the plastic ductwork. Nine-foot sections, 38 inches in diameter and with a ¼-inch wall thickness weigh but 185 pounds. An equivalent section in the lightest weight steel weighs at least 700 pounds, and requires the use of hoist equipment.

In addition to corrosion resistance, the fire-retardant qualities of Hetron proved an important factor. Some plating fumes have a fairly low flash point, thereby creating a fire hazard. This Hetron formulation has Underwriters' Laboratories listing and Factory Mutual Insurance approval as fire-proof, since it will not support combustion even under the direct flame of a blow-torch.

—THE END

News of the Societies

SPE Eastern New England

SPE's Eastern New England Section held a joint meeting with the Boston-Providence Chapter of SPI., at the Maridor Restaurant, Farmingham, Mass. Two speakers addressed the group; the first being Gene Bartczak, Industrial Consultant. He discussed "Fluorocarbon Coatings," pointing out the differences between polytetrafluoroethylene and polychlorotrifluoroethylene. Properties, methods of application, and uses were covered.

Bakelite's William Nissen spoke on "Plastics—Science Fiction or Practical Fact," reviewing the history of their development. He furnished statistics on the quantities used, their areas of application, and limitations.

NAPF Re-Elects Directors

All members of the board of directors for the National Association of Plastic Fabricators were re-elected at the group's first annual meeting. Continuing in their current capacities are: M. E. Soderstrom, Northway Products Co.; vice president, Arnold J. Gold, Topcraft, Inc.; secretary, H. P. Henningsen, Henningsen & Folsom; and executive secretary, Arthr J. Tuscany, Jr.

Other non-officer board members are Robert B. Fuqua, Fuqua Wood Products; Alvin Goldhush, Formed Laminates, Inc.; B. H. Murphy, Murphy & Orr Co.; H. M. Snyder, Sani-Top, Inc.; and Lee Trager, Custom Hall, Inc.

SPE Southern California

SPE's Southern California Section is sponsoring a regional technical conference on "Plastics for Airborne Electronics." The date is November 11, and the place is the Ambassador Hotel in Los Angeles, Calif. A highlight of the discussions will be a first-hand account of the earth's satellite by J. J. Markarian, engineer for the project.

Other topics and speakers are scheduled as follows: "Effects of Hardeners on the Electrical Properties of Reinforced Epoxy Laminates," J. P. Carey and R. H. Maybee, Shell Chemical Corp.; "Prediction of Mechanical Properties Through the Determination of the Electrical Properties of Plastics," J. Del Monte, Furane Plastics Co.; "Electrical Properties of Plastics as Influenced by Cure Conditions," J. J. Knudsen, Delson Corp.; "Inorganic Plastics and Synthetic Mica for Electronic Systems," J. H. DuBois, Mycalex Corp. of America; "New Developments in Isocyanate Base Polymers," M. E. Bailey, National Aniline division, Allied Chemical & Dye Corp.; "Silicones in Electronic Systems," K. H. Hoffman, Dow Corning Corp.; "Encapsulations in Electronic Systems," L. A. Dixon and R. H. Houghton, Houghton Labs.; "Polyurethanes in Electronic Systems," S. S. Assony and S. Chess, American Latex Corp.; "Plastic Coatings—Conductive & Insulating," Albert Davis, Plas-Kem Corp.; "Quality Control of Printed Circuits for Airborne Electronic Systems," B. A. Gerpheide, Hughes Aircraft Co.; and "Dielectric & Mechanical Properties of Potential Antennae Windows for Elevated Temperature Service," N. M. Mitchell and M. A. Nadler, North American Aviation.

Inquiries should be directed to Jack G. Fuller, Hercules Powder Co., 3460 Wilshire Blvd., Los Angeles 5, Calif.

Engineers Elect President

Garvin H. Dyer, director of the Missouri Water Co., has been elected president of the National Society of Professional Engineers. He is a past president of the Missouri Society of Professional Engineers, and has served on the board of directors of that organization.

Six regional vice presidents and a treasurer also were elected for the administrative year which began in July. They are as follows: A. H. Kidder, Northeastern region; John B. McGaughy, Southeastern region; Harry G. Kennedy, Central region; W. L. Hindermann, North Central region; Clark A. Dunn, Southwestern region; and L. R. Durkee, Western region. Russell B. Allen was elected to his tenth term as treasurer.

TAPPI Technical Conference

The 12th annual TAPPI Plastics-Paper Conference will be held at the Sheraton-Gibson Hotel in Cincinnati, O., on October 7-9. John F. Blais, Catalin Corp. of America will serve as chairman of the technical program committee.

Papers and speakers for the first day are listed as follows: "Impregnation of Paper with Acrylic Emulsions," E. J. Sweeney, Rohm & Haas Co.; "Latex Treatment of Paper," E. K. Thommon and V. T. Stannett, New York State College of Forestry; "Synthetic Fiber Papers," Hanns F. Arledter, Hurlbut Paper Co.; "High Density Polyethylene Coatings," Arthur E. Irvine and Harold A. Arbit, Bakelite Co.; and "Silicone Paper Coating," Joseph W. Keil, Dow Corning Corp.

Technical program for the second day includes: "Saturating Kraft Papers," Walter Hearn, Brown Co.; "Phenolic Resin Bushing and Core Winding," W. R. Penrod, Dilts division, Black-Clawson Co.; "A New Test for Post-Formability of High-Pressure Laminates," Curtis Elmer, Monsanto Chemical Co.; "Factors Influencing the Performance of Melamine Laminating Resin," H. P. Ledden and L. H. Updegraff, American Cyanamid Co.; and "Saturating Alpha Papers," R. H. Doughty, Fitchburg Paper Co.

SPE Upper Midwest Section

A regional technical conference on "Isocyanates" is being sponsored by SPE's Upper Midwest Section on October 8. The program will be held at the Curtis Hotel in Minneapolis, Minn. For further information, contact William Brooks, 1839 Carl St., St. Paul 8, Minn.

Subjects and speakers have been scheduled as follows: "Recent Advances in Urethane Materials," C. H. Wilson and W. L. Riedeman, Notre Dame University; "A Comparison of Properties between Polyester and Polyether-Based Isocyanate Foams," M. J. Sanger, G. T. Gmitter, and E. M. Maxey, General Tire & Rubber Co.; "Flexible Urethane Foams Derived from Polyethers," S. Davis, J. M. McClellan, and M. C. Frisch, Wyandotte Chemicals Co.; "High Temperature Urethanes," V. V. D'Ancicco, Carwin Polymer Products; "Rigid Urethane Foams," M. E. Bailey, National Aniline division, Allied Chemical & Dye Corp.; "Molding of Resilient Urethane Foams," R. E. Knox and W. J. Touhey, E. I. du Pont de Nemours & Co.; and "Storage Characteristics of a Polyurethane Resin," Joseph G. Fuono, U. S. Naval Powder Factory.

SPE Cleveland-Akron Section

SPE's Cleveland-Akron Section is sponsoring a regional technical conference on "Polyethylenes—Properties & Uses." Sessions will be held at the Hotel Carter in Cleveland, O., on October 17.

Topics and speakers are scheduled as follows: "Introduction and History of Polyolefins," J. K. Honish, Bakelite Co.; "Low Density Polyethylene," R. M. Campbell, E. I. du Pont de Nemours & Co.; "Medium Density Polyethylene," F. C. Sutro, Spencer Chemical Co.; "Linear Polyethylene," G. H. Sollenberger, Koppers Co.; "Blow Molding," E. E. Mills, Consultant; "Injection Molding," Milan Krajcik, Wooster Rubber Co., "Pipe Extrusion," Herbert Fackler, American Vulcathene Corp.; and "Film," C. J. B. Thor, Visking Corp.

Inquiries should be directed to E. J. Haskins, Zenith Plastics Co., 3901 Superior, Cleveland 14, O.

News of the Industry

Canadian Cyrovac Erects Plant

A large converting plant is being built in Toronto, Ont., by Cryovac Co., a division of W. R. Grace & Co. Designed to meet the growing demands for the firm's packaging materials in Canada, the new unit represents the first step in an over-all plant modernization and expansion program for 1957.

The Canadian market has been serviced by the company's oldest production unit in Lockport, N. Y. Present plans call for the gradual decrease of this plant's operations, with the domestic production slack being taken up by Cryovac's newer installations at Simpsonville, S. C., and Cedar Rapids, Ia.

Rents Radiation Accelerators

An Irradiation Center has been opened by Applied Radiation Corp., in Walnut Creek, Calif. Industrial and academic organizations interested in radiation processing can use one of the firms's linear electron accelerators on a rental basis, and ARCO will assist in planning experimental programs to the extent desired. Users are under no obligation to disclose results, or even the nature of their experiments.

The Center's 10-million electron volt Mark I-F2 accelerator is reportedly the highest-energy industrial accelerator operating in the United States. Its electron beam is equivalent to 140,000 curies of radioactive cobalt-60, about one-half of our annual domestic production.

Plastic Outboard-Motor Hood

Three major manufacturers of outboard motors have adopted a fibrous glass-reinforced polyester hood produced by General Tire & Rubber Co.'s Marion, Ind. division. The firm expects to produce more than 25,000 units during 1957, the first full year of production.

Among the advantages the plastic hood offers over metal are resistance to weathering, corrosion, and rust; light weight and sound-deadening qualities; design flexibility; and lower unit costs. The hood is as strong structurally as its metal counterpart, and will withstand considerably more abuse. Lower tooling costs keep its price below that of metal hoods.

The chopped glass strands are shot onto a perforated vacuum screen, sprayed with a polyester-water emulsion, vacuum-pressed onto a form, and cured. A catalyzed, polyester-filler combination is poured onto the form just prior to molding in matched metal molds. A 150-ton press is used for this final shaping and cure. The finished hoods are sprayed with a melamine-based enamel, and baked in an oven. The motor manufacturer adds his own distinctive trim and brand name identification.

MCA Elects Board Chairman

New Chairman of the board of directors, Manufacturing Chemists' Association, is Ernest Hart, president of Food Machinery & Chemical Corp. Other new officers elected at the 85th annual meeting were Harry B. McClure, vice president of Union Carbide Corp., as chairman of the executive committee; and R. L. Murray, Hooker Electrochemical Co., and D. S. Frederick, Rohm & Haas Co., as vice presidents. General J. E. Hull was re-elected president and director, and M. F. Crass, Jr., was re-elected secretary-treasurer.

Forms Building Products Group

Anticipating an increased demand for plastics in construction, Dow Chemical Co., Midland, Mich., has formed a building products group as part of its plastics technical service. Donald R. Gray will direct developmental work and technical service on such materials as plastic flashing, tank linings, saran-lined pipe, and other plastics now under development.

Rapidly expanding requirements for plastic pipe, sandwich panels, foamed-in-place materials, special films, plastic-covered wire, and other products led to the formation of the new group and should enable the company to broaden its developmental work and provide improved technical service assistance to fabricators.

Sponsors All-Day Conference

Advances in protective applications for non-fabric textile materials were discussed at a recent all-day conference held at the Polytechnic Institute of Brooklyn, Brooklyn, N. Y. The Institute, in cooperation with the research and development division of the U. S. Navy Clothing and Textile Office, designed several types of permanent and disposable protective clothing for de-

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contamination work, rocket fuel handling, and cold water immersion.

Among the items featured at the meeting was a newly-developed immersion suit for use in abandoning ship. Designed for wear over regular warm clothing, the suit is made from a waterproof, high tear-strength, open-textured nylon fabric laminated between two sheets of light vinyl film. This sandwich combination has tear- and hydrostatic bursting strengths of 14 and 180 pounds, respectively, and will not break when the wearer strikes the water. Eight-mill vinyl film, used by itself in previous designs, had corresponding characteristics of one and 28 pounds.

Conference chairman, J. J. Press cited the following approaches for making the textiles: direct conversion of high polymers into sheet form; expansion of foams into light weight sheets for insulation; bonding a web of fibers coming from the carding machine with a rubber-like material; and production of materials with present paper making machinery.

Expands Polyethylene Capacity

A building program is under way at Spencer Chemical Co.'s plant at Orange, Tex. Designed to double production of conventional and medium density polyethylene, the completed project should enable the company to make an annual delivery of 90-million pounds.

Forecasts of a 250-million pound increase in conventional polyethylene consumption within the next four years reportedly was responsible for the company's decision. Spencer, a licensee under Standard Oil of Indiana patents for low-pressure processes maintains pilot plant facilities for producing high density polyethylene, polypropylene, and copolymers of both in Pittsburg, Kan.

Plastic Age Announces Plans

A plastics fabrication plant consisting of seven buildings, and encompassing 60,000 square feet of floor space, is being built by Plastics Age Co., San Fernando, Cal. An estimated total of $1-million has been spent on the project, which will double and eventually quadruple the company's output. The plant is being constructed at the junction of Davenport Road and Highway 6, in Mint Canyon.

Buildings housing the company's administration, research and development, processing, fabrication, and tooling and power plant facilities are being erected on a 110-acre site, which also accommodates a heliport and an 85,000 gallon water storage tank. As a safety measure, chemicals and volatile materials are to be stored in a building separate from the others.

Processing and fabrication equipment are provided with steam, air, vacuum, and hydraulic power sources, to eliminate work stoppage in the event of an electrical power failure. Manufacturing areas are provided with a minimum 100-candle power lighting which is supplemented by daylight entering through plastic glazing.

The program required more than three years of planning, and occupancy is scheduled for late this summer. No production slow-down is expected as the present plant will continue at 100% capacity until the new one is in full operation.

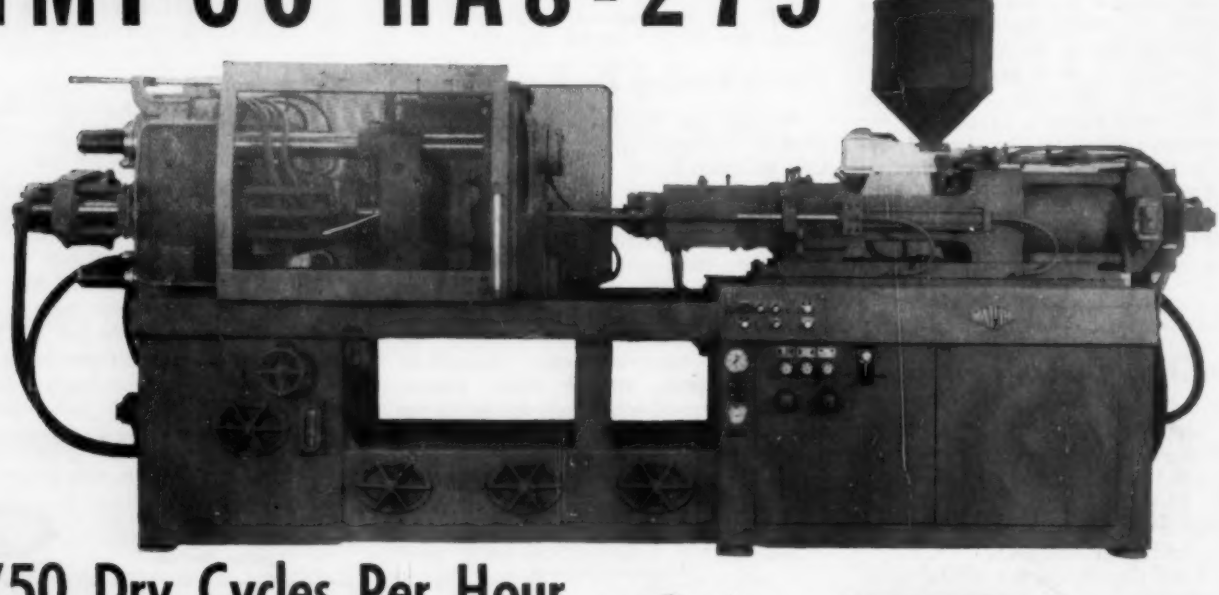
Auburn Changes Name

Effective this month, Auburn Button Works, Inc., Auburn, N. Y., becomes Auburn Plastics, Inc. The directors decided that the change would better indicate the present nature of the company's business.

Founded in 1876 by J. Herman Woodruff, Auburn first machined buttons from shell, later molded them from a shellac composition, and finally progressed to the use of phenolics and ureas. Buttons, however, became a steadily decreasing factor in the company's business and were discontinued in 1945.

Today, Auburn molds and extrudes component plastic parts for automobiles,

IMPCO HA8-275



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business machines, and general industry. The company employs more than 600 people to operate two plants with a total manufacturing space of 160,000 square feet.

Phthalic Anhydride Facility

A $3-million plant for the production of phthalic anhydride has been erected for the industrial chemicals division, Pittsburgh Coke & Chemicals Co. Located at Neville Island near Pittsburgh, Pa., the facility was designed and engineered by the Lummus Co., of New York City. Newly-instrumented process equipment is expected to double the company's production capacity.

Plans Vinyl Foam Production

Development work on basic resins for making vinyl and other foamed plastics has led to plans for still greater activity in that field by Union Carbide Corp., New York, N. Y. The initial steps involve the company's recent acquisition of patents and experimental equipment formerly owned by Elastomer Chemicals Corp.

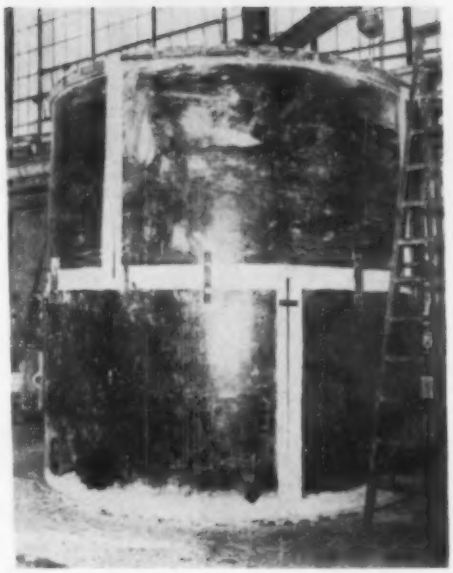
While neither firm has produced vinyl foam commercially prior to this time, Union Carbide hopes to capitalize on the expanding market for this material which currently is estimated at 3-million pounds per year.

Numerous foreign and domestic licenses have been granted under the patents, and the company proposes to offer additional licenses and to make technical production data available to the licensees. This activity will come under the product and process development department of the Bakelite Co., a division of Union Carbide.

Forms Subsidiary Corporation

Construction of a $225,000 plastics molding plant at Gastonia, N. C., was completed recently by Northwest Plastics, Inc., St. Paul, Minn. A subsidiary corporation, called Northwest Plastics of Carolina, Inc., has been formed to handle the company's first branch operation.

Directed by officers of the parent company, the 10,000 square-foot facility will be used to employ some 50 persons in the production of intermediate plastic parts used in the manufacture of electric and electronic components. Northwest Plastics, a custom molder and manufacturer of industrial parts, will continue its operations at the St. Paul plant.



Cylindrical plastic tank is assembled at the customer's plant.

Offers Tanks Within Tanks

A convenient and inexpensive method for converting worthless, old, industrial tanks into usable systems has been developed by Haveg Industries, Inc., Wilmington, Del. Using such plastics as asbestos-filled phenolics, graphite-filled epoxies, or glass-reinforced polyesters, the firm molds or cements a lining into the old tank, thus forming a chemically-resistant "tank within a tank."

This lining has been installed successfully in steel, wood, and concrete vessels with diameters up to 55 feet. It is not a coating, but an entirely new plastic tank formed by using the outside structure as a mold. If desired, the outer shell can be removed when fabrication is completed.

A second method uses pre-molded sections cemented together at the erection site, thus permitting indoor construction. An advantage cited for this technique is that sections can be assembled within the room or building. This obviates the need of enlarging entrances or changing the position of equipment which would prevent the entry of large tanks. Field fabrication of plastic vessels also eliminates welding operations, which could be hazardous in areas where combustible or explosive vapors accumulate.

Erects Petrochemicals Plant

A $4-million dollar petrochemicals plant having a 45-million gallon per year extraction capacity, has been placed in operation by the newly formed chemical division of the Delhi-Taylor Oil Corp., Corpus Christi, Tex. While initial production is limited to benzene, toluene, and xylene, methods are being studied to broaden the division's output.

Sales, advertising, marketing, and new developments will be supervised by Harry W. Dudley from the divisional sales office in New York City.

Forms Laminates Division

A new division for the production and development of specialty laminates has been formed by Liberty Corrugated Container Corp., New York, N. Y. Known as Liberty Laminates, the new company enters into commercial operation after 12 months of experimental and pilot plant runs.

Among the products currently available are foils, glassines, cellophanes, mylars, fabrics, leatherettes, fire-retardants, and vapor-proof materials. The company's facilities permit material widths up to 78 inches.

Expands Acrylonitrile Plant

An expansion program is presently underway at Monsanto Chemical Co.'s acrylonitrile plant in Texas City, Tex. Part of the expected 100-million pound annual output will be used for the production of acrylic fibers by Chemstrand Corp., Decatur, Ala. The latter firm, owned jointly by Monsanto and American Viscose Corp., is enlarging its facilities to handle an annual 45-million pound production of the synthetic fibers.

Doubles Manufacturing Area

Construction work is nearing completion at Cryovac Co.'s plant in Simpsonville, S. C., which will bring the firm's investments at that site to over $1-million. The new facility duplicates the original plant in exterior and layout, and will be put in operation by stages as the anticipated demand for films and bags is realized. Full-scale production is expected by 1961.

Opens Urethane Foam Plant

A processing plant to be devoted solely to urethane foam production and research has been opened at North Arlington, N. J., by Nopco Chemical Co. The building was designed to expedite future expansion, and its 32,000 square feet of floor space accommodates production units, laboratories, and sales offices

Opening of the new facility marks Nopco's first major expansion in the plastics field, and will enable it to make an annual product delivery of 5-million pounds to the foamed plastics market.

Architect's drawing of the new Nopco plastics plant.

Broadens Sales Coverage

The Rainville Co., Inc., Garden City, N. Y., has announced the opening of three new district ranches; appointment of three organizations as sales representatives; and the addition of personnel to existing offices. The expansion is designed to broaden the company's sales coverage of equipment to the plastics industry, and brings their number of branch offices throughout the country to a total of 12.

New supervisory district managers and sales offices include: Nicholas Gerten, Framingham, Mass.; F. L. Miller, Dayton, O.; and Hal Fisher, Farmington, Mich.

Companies representing Rainville, their locations, and designated areas are: The Royal E. Fisler Co., St. Louis, Mo., Missouri, Iowa, Kansas, and Nebraska; Sterling and Newby, Inc., Dallas, Tex., Texas and Oklahoma; and R. R. Walters and Associates, Minneapolis, Minn., Northern Wisconsin, Minnesota and the Dakotas.

Allan Niebuhr has been named field engineer for northern New Jersey, and has headquarters at Abbington, Pa.; Fred Mears, sales service engineer, will operate from the New York City office; Charles E. Worden has been appointed field engineer with company's branch at Franklin, Pa.; and Richard Moses has been named manager of extruder sales at Alhambra, Cal.

Dewey & Almy's radioactive cobalt 60 unit.

Acquires Cobalt 60 Unit

A radioactive cobalt 60 unit has been added to the laboratory facilities of Dewey & Almy Chemical Co., Cambridge, Mass. With its acquisition, the company plans to utilize gamma radiation in expediting its physical and chemical research procedures.

The cobalt is in the form of a slender, hollow, tube about two feet long, and is sealed in a protective, two-ton lead sheathing about the size and shape of a 55-gallon drum. A remote control "arm" is used to lower samples into the tube, where they may be exposed to radiation for indefinite periods.

Increases Plasticizer Output

New facilities for producing plasticizers have been completed by Deecy Products Co., Cambridge, Mass. Part of the company's over-all expansion program, they should provide an increased capacity of 12-million pounds per year. Deecy has been manufacturing Staflex plasticizers for over 30 years, and also markets a line of vinyl stabilizers.

Builds Testing Laboratory

An adhesives research and testing laboratory has been built at Stratford, Conn., by Raybestos-Manhattan, Inc., Manheim, Pa. Its equipment includes tensile machines for shear and peel tests; ovens for producing temperatures to 600°; pilot mixers; salt spray testing cabinets; and a humidity testing area. To supplement its own equipment, the adhesives department also has access to analytical laboratory facilities at the company's Stratford plant.

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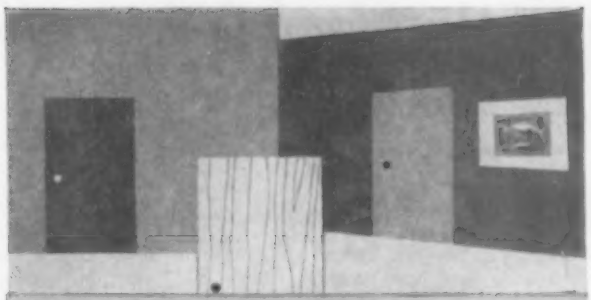
In selected applications these properties are unmatched by existing resins. DAPON resin should be evaluated for use as the base resin in any thermosetting application requiring chemical resistance, heat and humidity resistance, superior electrical properties, good moldability, or dimensional stability.

Extensive testing programs have been completed to point up those uses and applications in which DAPON resin has distinct merit and produces decidedly better properties. Molding compounds with various fillers, reinforcing fibers and colors are now available. Government approval under a number of military specifications has been obtained.

Let us know the application you have in mind for DAPON resin . . . write now for literature and technical data.



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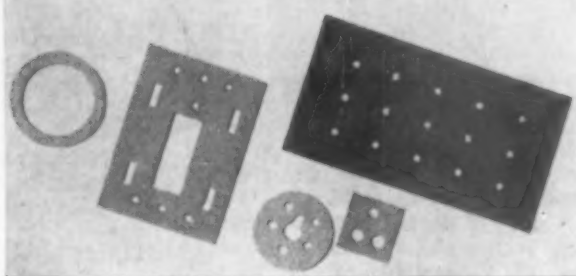

INDUSTRIAL LAMINATES made with DAPON resin have a number of outstanding properties: Superior electrical properties e.g., high insulation resistance retained under conditions of high humidity; heat resistance without degradation even under sustained vibrational stress. Other advantages exist in end uses requiring a high degree of chemical and moisture resistance, good dimensional stability, mechanical strength and ease of machinability. Formulated with or without volatile solvents DAPON resin is suitable for use in the full range of pressure curing conditions.

MOLDED ELECTRICAL PARTS containing DAPON resin exhibit highest resistance to humidity changes. Maximum retention and rapid recovery of electrical properties are insured by the unmatched stability of DAPON resin and the absence of deleterious products of degradation under long term use conditions. Properties of dielectric strength, dielectric loss, volume resistivity and arc resistance are particularly outstanding. Very low molding and post molding shrinkage allow close tolerances and the use of closely spaced inserts. Moldability and resistance to heat and chemicals are excellent.

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News from Abroad

ICI Develops New Polymers

Imperial Chemical Industries' plastics division has developed new polymers from 3:3-bis chloromethyl oxacyclobutane. Similar to Penton, a chlorinated polyether now being produced by the Hercules Powder Co., these polymers have a melting point of about 180° C., are partially crystalline, and have a melt viscosity of a few thousand poises at 260° C.

Tests carried out on compression moldings in the form of thin plates produced at 195° C., indicate molding properties more clearly resembling those of polyethylene than of nylon. Oxygen absorption at 100° C., as determined by modified Bancroft apparatus, is substantially lower than that of polyethylene at this temperature, and can be reduced further by small additions of anti-oxidants.

A study of the crystallization kinetics of these polymers showed mold temperatures near 100° C., would be required for highly crystalline moldings. Quenching to 0° C., produced amorphous polymers. X-ray crystallography revealed two crystal forms: an alpha form produced when the polymer was cooled slowly through the crystal melting point; and a beta form, produced when quenched amorphous material was allowed to crystallize by raising the temperature above the glass transition temperature (7° C.).

The oxacyclobutane polymer withstood the accelerated cracking test developed by Bell Telephone Laboratories and, because of the high chlorine content (46%), burned with difficulty. The material has useful electrical and mechanical properties over a wide temperature range, especially beween 20° and 120° C. Here, the properties are very similar to those of polyethylene terephthalate. Outstanding characteristics include negligible water absorption and resistance to hydrolysis.

Introduces Two Polypropylenes

A feature at the latest Milan Exhibition was Moplen, an isotactic polymer of propylene developed by Montecatini at its petrochemical plant in Ferrara. Two types, differing in molecular weight and some properties, are available on a commercial scale.

Type I has the lower molecular weight, is more fluid in the melted state, and is particularly adapted to extruded film and monofilaments. Type two is suitable for injection molding and general extrusion, including complicated shapes in thin section. Coloring is no problem, provided care is exercised in selecting pigments which will withstand molding and extrusion temperatures. Finished articles have a smooth, shiny surface which usually requires no further finishing.

Moplen can be cut, sawed, worked on a lathe, welded, and nailed. Available in granular form, it can be supplied in powder form if so desired. Physical properties are reported as follows:

Specific gravity	0.9-0.91
Tensile strength, kg/cm.	300-380
Elongation at break, %	500-700
Flexural strength, kg/cm.	8,000-12,000
Compressive strength, kg/cm.	600-700
Hardness, Rockwell R	85-95
Melting point, °C.	164-170
Dielectric strength, KV/mm.	30-32

Polish Polystyrene Plant

A large scale polystyrene plant, to be designed by Great Britain's Petrocarbon Developments, Ltd., has been ordered by the Polish government. While British goods and services are expected to have a sterling value in the neighborhood of 350,000 pounds, most of the necessary equipment will be made in Poland. The process to be used in the Polish plant is similar to other Petrocarbon installations designed for Styrene Products, Ltd., and for a French plant owned by the Pechiney group.

German Industries Fair

A screw-type injection molding machine, designed by Ankerwerke Gebr., Goller, Nuernberg, excited considerable interest among plastics processors attending the German Industries Fair held recently in Hanover. The unit is characterized by a single-screw preplasticizing system which serves also as a conveyor and injection plunger. Since the material is fully plasticized upon entry into the mold, injection pressures can be reduced and molding capacity increased. Of the two models produced by this firm, DV 10, has a polystyrene shot capacity of 275 grams, while DV 16 will handle up to 730 grams.

German and foreign processors have tested the machine on 50 different materials including polystyrene, glass-clear plexigum, and transparent Hostalen (polyethylene). It is claimed that difficult-to-mold compounds such as rigid PVC, Luvican (polyvinyl carbazol), and high molecular weight materials can be worked easily and with greater precision. Powdered materials also can be used.

Maschinefabrik Albert Stubbe, Vlotho-Weser, Kalldorf, exhibited a hydraulic injection molding machine with a screw plunger unit (B.A.S.F. license). This company's machines are designed with interchangeable plunger and screw-plunger parts to facilitate conversion, and temperatures are controlled automatically by an electronic means.

A third machine seen at the fair was designed by Eckert & Ziegler, G.m.b.H., Weissenberg, Bavaria, in cooperation with A. Reifenhauser, Troisdorf. The unit has a screw type plasticizing unit which, by axial movement at the time of injection, operates as a plunger.

Vinyl Film-Steel Laminate

A laminate of vinyl film and steel has been developed by the British Iron & Steel Research Association at its laboratories in Swansea, Wales. Called Plasteel, the laminate is made by the BSRA process which is claimed superior to the American process. Bonding is so permanent, that the film cannot be separated from the steel without breaking.

Peel strength tests with 10-mil films have shown values of 30 pounds per square inch. Samples have been bent, sheared, lock-sawed, roller-formed into sections, and deep-drawn into cups 1⅜ inch in diameter by two inches deep. An outstanding feature of the material is its heat resistance. Drawn cups can be immersed in boiling water for an hour without adhesion failures. Plasteel cups have withstood immersion in glycerine at 200° C., for a few minutes; however, this material tends to decompose the plastic.

ADM Licenses German Company

Archer-Daniels-Midland Co., Minneapolis, Minn., has carried out its sixth foreign expansion in less than a year. A plant has been erected at Ruhle, West Germany, which will produce plasticizers and synthetic resins under ADM licenses. It will be operated by Scado-Archer-Daniels GmbH & Co., which is owned by ADM and its German and Dutch partners.

The plant's first unit is now in production, and two other units are in the process of being installed. The new firm will utilize the laboratory and technical staff of Scado-Archer-Daniels, NV, a Dutch manufacturer in which ADM recently acquired an interest.

Forms Benelux Corporation

The formation of a Belgian firm, Sidaplex, S. A., to manufacture and sell plastic bottles and hollow containers from polyflex biaxially-oriented film has been announced by Plax Corp., Hartford, Conn. Principal shareholders are Plax and Societe Industrielle de la Cellulose, a leading Belgian manufacturer.

The new firm will have its headquarters in Brussels and its manufacturing facilities in Ghent. Both cities are in Belgium. Operations will be conducted primarily in the Benelux countries.

Girdler Adds Three Companies

Three additional foreign companies have been granted Elastomer process licenses by Girdler Co., Louisville, Ky. The new licensees include Oy Finlayson-Forssa AB, Tammerfors, Finland; Japan Leather Manufacturing Co., Ltd., Tokyo, Japan; and Imperial Chemical Industries, Ltd., Welwyn Garden City, Hertfordshire, England. This brings to a total of 10, the number of overseas firms using the Elastomer process to produce vinyl foam.

The initial production of Oy Finlayson Forssa and the Japan Leather Mfg. Co. will be limited to continuous slab form foams, with a later expansion into molded products being planned. Both companies are equipped with Girdler's Votator foaming apparatus, and Thermex high frequency dielectric heating equipment.

The license agreement with Imperial Chemical Industries calls for experimental operations to be undertaken by that company's plastics division. Girdler pilot plant equipment is being installed for that purpose, and the arrangement will place ICI in a position to discuss experimental data and production techniques with Elastomer process licensees in overseas areas.

Bakol S. A. Granted License

Bakol S. A. Industria E. Commercio, Sao Paulo, Brazil, now will manufacture Campco-type thermoplastic sheet in a variety of materials including GM high-gloss styrene, in accordance with a licensing agreement recently completed with Campco Division, Chicago Molded Products Corp., Chicago, Ill. Representatives of the Brazilian firm will be trained in this country in Campco's merchandising and technical methods.

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Names in the News

S. W. Jones, Jr.

S. W. Jones, Jr., has been appointed manager of plastics development for organic chemicals division, Food Machinery and Chemical Corp., New York, N. Y. He formerly was with the M. W. Kellogg Co.'s chemical manufacturing division, where he worked on sales and development of Kel-F plastics.

R. E. Cornwell has been appointed president of Union Carbide Development Co., division of Union Carbide Corp., New York, N. Y. Joining the firm in 1923, he has held key engineering positions, eventually becoming vice president of Linde Co. in 1942, and vice president of the newly formed Union Carbide Development Co. in 1956.

George G. Stier, vice president in charge of the plastics division, Nopco Chemical Co., Harrison, N. J., has competed 25 years of service with that company. At a party for long service employees, he was presented with a gold watch by **Ralph Wechsler,** president. Mr. Stier began his career with Nopco as a helper in the company's control laboratory. He was elected to his present post in November 1955.

A. J. McConvey has been appointed plastics sales manager for Canadian General Electric Co., Ltd., Toronto, Ont. He replaces **R. F. Harrison** who has been named manager of plastics. Both men will be headquartered at the firm's Cobourg plant.

Three new sales representatives have been appointed to the organic chemicals division, Dewey and Almy Chemical Co., Cambridge, Mass. **Cornelius F. Sullivan,** formerly with Dow Chemical Co., will cover the New England states, **Amos J. Minor,** previously of the J. T. Baker Chemical Co., is assigned to the Chicago, Ill. office to serve the Midwestern area, while **James H. Aungst,** formerly of Merck & Co., will serve South Carolina, Florida and Georgia. He succeeds **Oscar W. Kaalstad,** who has been transferred to the West Coast.

C. F. Brunson has been named director of resin products sales for Monsanto Chemical Co.'s plastics division. He previously served as sales manager of the western adhesives department and as Seattle, Wash. district manager. He is succeeded by **A. L. Bonutto,** who has served as assistant in those capacities since 1954. **Milton Freifeld** has been appointed laboratory supervisor at Addyston, O. for Monsanto's plastics division. He formerly was senior research chemical engineer at Springfield, O.

Eric Sheldon

Eric Sheldon has been appointed research chemist with the chemical processing division, Auburn Button Works, Inc., Auburn, N. Y. He formerly was associated with Metal & Thermit Corp.

Warren J. Flynn, formerly with the organic chemicals division, American Cyanamid Co., has joined the staff of Haveg Industries, Inc., and will serve as district sales engineer in the firm's Chicago, Ill. office. **George M. D. Hart** has been appointed to Haveg's sales force and will be headquartered at the company's home plant in Wilmington, Del.

Herman Sokol, vice president, research and development, will head the newly integrated research department of the Heyden Newport Chemical Corp., New York, N. Y. Other appointments resulting from the realignment of the organization include: **Carl Bordenca,** to director of research; and **J. Harry Stump,** to a manager of research at Newport Industries Laboratories in Pensacola, Fla. **X. Klein** will continue as manager of Heyden's Garfield, N. J. research center.

Robert B. Wilbur

Robert B. Wilbur, former manager of polyurethane product sales, has been named general sales manager of the Marion, Inc. division of General Tire & Rubber Co. He previously served as manufacturers sales representative for the firm's Eastern division.

A. B. Gordon has been named product manager of the Koroseal film and coated fabrics department, B. F. Goodrich Industrial Products Co., Marietta, O. In his new position, he will be responsible for pricing and development of Koroseal—coated fabric and film.

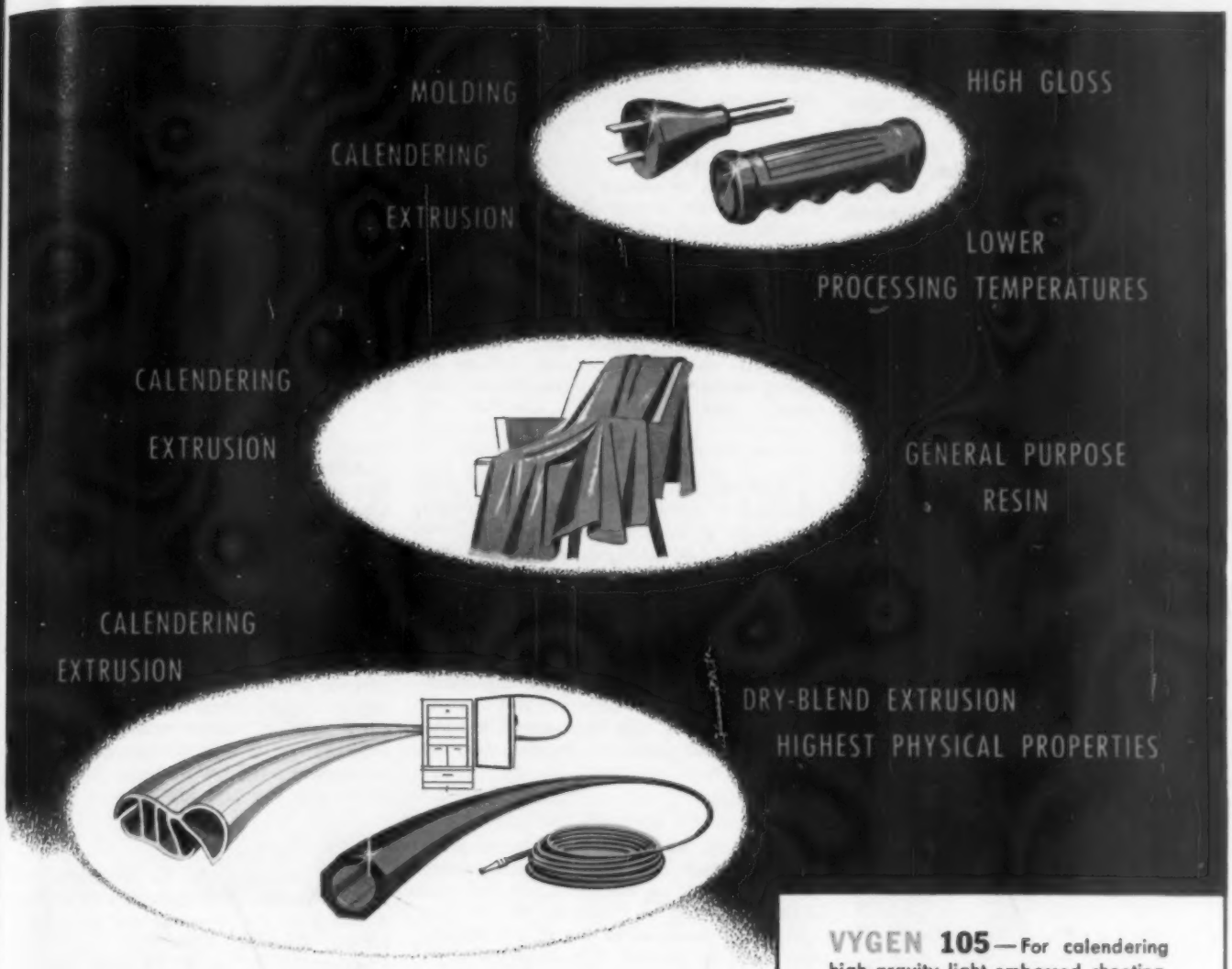
Richard W. Jakubek has been appointed sales manager of Strick Plastics Corp., Perkasie, Pa. He joined the firm two years ago, after having operated his own company in Long Island City, N. Y.

Leon J. Breton has been elected assistant vice president of American Mineral Spirits Co., Chicago, Ill. His association with Amsco has included such positions as metropolitan divisional manager at the company's Eastern headquarters and manager of market research and development at Chicago, Ill. In the latter capacity, he was responsible for market survey activities and consumer research on solvents, petroleum derivatives, and petrochemicals.

Gilbert G. D'Andrea has joined Durable Formed Products, Inc., New York, N. Y., as director of product development engineering. In his new capacity, he will supervise the firm's engineering department and will cooperate in the handling of manufacturing design services.

Richard M. McFarland

Richard M. McFarland, a former member of the central development department, has been appointed product manager-plastics for the organic chemicals division, Food Machinery and Chemicals Corp., New York, N. Y.



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VYGEN 105—For calendering high-gravity light-embossed sheeting, and for molded items and extrusions requiring a high-gloss finish. This resin can be processed alone or with other resins, permitting lower processing temperatures.

VYGEN 110—A general purpose, average molecular weight resin, especially adapted for easy processing of calendered film, sheeting and coated fabrics . . . also recommended for certain molding and extruding applications.

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Reassignment of five technical representatives has been announced by Union Carbide Chemicals Co., New York, N. Y. These include: **A. A. Douglas,** Albany, N. Y.; **R. R. Failla,** Buffalo, N. Y.; **H. R. Hubbs,** Charlotte, N. C.; **C. D. Schmidt,** Newark, N. J.; and **R. J. Spath,** Chicago, Ill.

Ernest G. Campbell, a 37-year veteran with the Peoples Gas Light & Coke Co., has retired from that organization to become a manufacturer's representative for Perfex Plastics, Inc., Chicago, Ill. One of the first in the gas field to experiment with epoxy resins as a leak-sealant, he now will concentrate on corrosion control.

The appointment of an assistant general manager and five section managers has been announced by Bakelite Co., New York, N. Y. These include: **A. J. Falconer, Jr.,** assistant general manager; **G. W. Crane,** advertisements; **V. J. Pianka,** art, printing and circulation; **W. J. Connelly,** market programs and public relations; **R. W. Matthews,** publicity and presentations; and **J. F. Lynch,** technical writing.

Stanley B. Mulder

Stanley B. Mulder has been named Midwestern district manager of Plaskon industrial resin sales for Barrett Division, Allied Chemical & Dye Corp. He will maintain headquarters at Toledo, O., where he has been serving as area representative. His successor, **Thomas A. Bennett,** was named to the vacated position after completing a training program at several of Barrett's laboratories.

George R. Vila, vice president and general manager of Naugatuck Chemical division, United States Rubber Co., Naugatuck, Conn., has been elected a member of the board of directors of the Manufacturing Chemist's Association.

William Demarest has joined the staff of the Manufacturing Chemists' Association, Washington, D. C. As director, plastics in construction, he now works with building officials and municipalities, in cooperation with the SPI, to negotiate building code revisions which will permit the wider use of plastic materials where it is shown they meet all necessary safety and performance standards.

Paul H. Skelton

Paul H. Skelton, formerly with Solar Aircraft Co., has been named administrative assistant at Narmco, Inc., San Diego, Cal. His new responsibilities include supervision of contract administration, personnel, and purchasing.

William L. Abramowitz, former vice president of Borden Co.'s chemical division, has been elected president of Carlon Products Corp., Cleveland, O. **Louis J. Jaworski** has been appointed manager of government services for the chemical division. He formerly served as product manager of the industrial adhesives department. **Andre G. Duzsic** has joined the organization as manager of manufacturing operations for the Resinite department. Formerly a plant manager with Monsanto Chemical Co., he will maintain headquarters at Santa Barbara, Cal.

Robert M. Austin has been named plant superintendent for the polycomonomer department of the Borden Co.'s chemical division located at Illiopolis, Ill. He formerly was general foreman of the department, and was named acting superintendent last November.

Edward Filiurin has been appointed sales manager of the newly formed vinyl plastic sheeting division, Elm Coated Fabric Co., New York, N. Y. He will direct sales to the leather goods, furniture, and automotive fields.

S. J. Pappalardo has been appointed merchandising services supervisor for Polymer Chemicals division, W. R. Grace & Co., New York, N. Y. He formerly did sales promotion and market research work for the firm's Cryovac division.

J. Guy LaVergne, former chief design engineer, has been made chief engineer at the Pensacola, Fla. plant of Escambia Chemical Corp., New York, N. Y.

John C. Louer, formerly associated with the Elmer E. Mills Co., has joined the staff of Artag Plastics Corp., Chicago, Ill., as production control manager.

W. Raymond Ahrberg has been named technical salesman for the carbon black and pigment division, Columbian Carbon Co., New York, N. Y. He joins the Akron, O. office, replacing **William E. Ford,** who has been transferred to technical service. **Alden H. Davis** has been appointed resident technical service manager for Companhia Petroquimica Brasileira-Copebras, Sao Paulo, Brazil, a joint enterprise of Columbian Carbon Co., and other American and foreign interests.

Hugh P. Kelly, merchandising and advertising counselor, has been appointed New England representative for Emet Plastics, New York, N. Y. He maintains offices in Boston, Mass.

Alfred A. Rodick, former chief engineer for molded products division, Admiral Corp., has been appointed chief engineer for G. Felsenthal and Sons, Inc., Chicago, Ill.

Reuben Gutoff has been named manager of resins and fluids operations of the silicone products department's manufacturing section, General Electric Co., Waterford, N. Y. A former manager of process engineering, he now is responsible for the production of silicone resins, fluids, emulsions, and specialty products.

R. I. Hoaglin, A. E. Montagna, and **H. W. Schultz,** have been named associate directors of the development department, Union Carbide Chemical Co., South Charleston, W. Va. **R. M. Berg** has been appointed administrative assistant to the director in addition to his supervisory duties as head of the quality control laboratory.

Four new appointments to sales service have been announced by Catalin Corp. of America, New York, N. Y.: **John Ziccarelli,** New York, N. Y.; **Herman Pickles, Jr.,** Chicago, Ill.; **E. B. Lee,** Houston, Tex.; and **Glenn Nebel,** Los Angeles, Calif.

Robert L. Toole

Robert L. Toole has been assigned to B. F. Goodrich Chemical Co.'s plant at Niagara Falls, N. Y., where he will be in charge of the recently-expanded vinyl resin production facilities. He replaces **Dan C. Campbell,** who was transferred recently to the project engineering department at the company's main office in Cleveland, O.

Names in the News (Cont'd.)

J. H. Field, D. P. Heath, and **P. W. Pontius,** have been assigned to positions in polyethylene production at Carbide Chemicals Co.'s plant, Institute, W. Va. Mr. Field, former department head at the firm's South Charleston, W. Va. plant, becomes area supervisor. **Mr. Heath,** previously a technical assistant at the South Charleston, W. Va. polyethylene pilot plant becomes a department head; as does **P. W. Pontius,** former technical assistant in the Institute, W. Va. butanol department.

L. R. Hunter has been named Midwestern sales manager for the chemical division, Koppers Co., Inc., Pittsburgh, Pa. Joining Koppers as a plant foreman in 1943, he subsequently served as a sales representative until 1955 when he was promoted to assistant manager, plastics products section.

Edward V. Huda

Edward V. Huda has been named director of research and development for the adhesives department, Raybestos-Manhattan, Inc., Bridgeport, Conn. He formerly was a project supervisor in the research and product development of the firm's Raybestos division.

John P. Case has retired as plastics division manager of S. S. White Industrial Division, New York, N. Y. A veteran of 18 years service, he will continue to serve the company as a consultant.

Eugene Sinnett has been promoted from plant to general manager of the Corrolux division, L. O. F. Glass Fibers Co., Toledo, O. He is succeeded by **James L. Neill,** former division comptroller. **George N. Sadorf,** previously Mr. Neill's assistant, has been named comptroller.

Horace A. Ory has joined the research department of Monsanto Chemical Co.'s plastics division at Texas City, Tex. Other assignments at this branch include: **Carl R. Perkins, Jr.,** control laboratory; **Edward M. Thomason, Jr.,** instrumentation department; and **John M. Schnakenberg** and **Cecil B. Shelton, Jr.,** production department. **Louis J. Chabot** has been assigned to the plant engineering department at the division's facilities in Springfield, Mass.

Richard C. Horton, former industrial textile development manager of Owen-Corning Fiberglas Corp., has joined the fiber glass department of J. P. Stevens & Co., Inc., New York, N. Y. In addition to working in research and development of both industrial and decorative glass fibers, he will be associated closely with the fiber glass textile and plastics laboratories at the Stevens glass weaving and finishing plant at Slater, S. C., and with fiber glass testing at the company's central laboratories.

Relocation of three district managers and five technical representatives has been announced by Union Carbide Chemicals Co., New York, N. Y. The district managers and their new assignments include: **G. E. Keuhn,** to Detroit, Mich.; **Julian Paul,** to Baltimore, Md.; and **D. F. Swartz,** to Buffalo, N. Y. Transferred technical representatives are: **D. H. Merry,** to St. Louis, Mo.; **T. L. Proctor,** to Detroit, Mich.; **R. G. Short,** to Cincinnati, O.; **E. A. Vierengel,** to New York, N. Y.; and **A. H. Welle,** to Boston, Mass.

E. W. Hunnicutt has been appointed sales representative, New England district, for the Campco Division of Chicago Molded Products Corp. He maintains headquarters at West Hartford, Conn.

Lamson Corp., New York, N. Y., has announced the appointment of **Earl D. Hoyt** to manage the firm's regional office at Cleveland, O. His duties include supervision of the sales, installation, and engineering of materials handling equipment marketed in Ohio, Indiana, Michigan, Kentucky, West Virginia, and western Pennsylvania.

William C. Foster has been named sales representative for urethane chemicals by Mobay Chemical Co., St. Louis, Mo. He will serve the north central states and portions of Canada from his headquarters in Akron.

Paul M. Jensen, former supervisor of plastics sales at Dow Chemical Co.'s Detroit office, has been transferred to company headquarters at Midland, Mich., where he will handle special assignments in connection with molding materials. He is succeeded by **John E. Donalds,** who had served as a coatings salesman at the company's office in Cleveland, O.

R. K. Thomson has been appointed New England district sales manager for the plastics division, Celanese Corp. of America. In taking over his new position at Leominster, Mass., he succeeds **S. W. Murray** who has been given a special marketing assignment for the general manager of the division.

Lawrence G. Lane

Lawrence G. Lane has joined Fabricon Products Division, Eagle-Pitcher Co., as vice president in charge of the firm's plastics impregnating, laminating, and automotive division at Los Angeles, Calif. In his new position, he will assume direct management responsibility for the development, manufacture, and marketing of all products made by the company's West Coast branch.

John J. Philbin has been named Los Angeles regional manager of polyurethane foam sales for The General Tire & Rubber Co., Akron, O.

Alby Wolf has joined the chemical engineering research department of General Mills, Inc., Minneapolis, Minn. Prior to this appointment, he had been with the firm on a part time basis while completing his studies at the University of Minnesota.

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LOW COST
MICA
FLAKES For
REINFORCING?

Increased electrical insulation. Compatible with all types of resins. Stocks in principal cities.

U. S. MICA CO., INC.
79 PROSPECT ST.
STAMFORD, CONN.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Glass-Filled Molding Compound

A fibrous glass-reinforced polyester, designed especially to meet military specification MIL-M-14E for type MAI-60 molding compounds, has been introduced by Atlas Powder Co. Called Thermaflow 800, the material should find applications as electronic computer parts, electrical fuses for projectiles, electric equipment control housings, and as replacements for metal parts.

Features claimed for the material include high strength, flame resistance, electrical resistance, heat resistance, and moldability. Compound and molded properties are reported as follows:

Bulk factor	3
Form	Fibrous putty
Color	Dark gray
Shelf life, min. mos. below 90° F.	2
Water absorption, 24 hrs. @ 23° C., %	0.1
Specific gravity	1.8
Mold shrinkage, in./in., compression	0.001
Transfer	0.003-0.004
Hardness, Barcol	70-75
Impact strength, Izod, ft. lbs/in. notch	12-24
Flexural strength, psi.	20,000-25,000
Compressive strength, psi.	22,000
Tensile strength, psi.	6,000-10,000
Modulus of elasticity, psi. x 10^6	2
Heat distortion point, 264 psi., °F.	450
Ignition time, sec.	105
Burning time, sec.	70
Classification	Self-extinguishing
Arc resistance, sec.	150
Dielectric constant, 1 kc., dry	5.27
Wet	6
At 1 megacycle, dry	0.015
Wet	0.05
Dissipation factor, 1 kc., dry	0.03
Wet	0.05
At 1 megacycle, dry	0.015
Wet	0.05
Insulation resistance, megohms x 10^7	1
Dielectric strength, v/mil, short time, dry	300
Wet	180
Step-by-step, dry	245
Wet	145
Volume resistivity, ohm-cm. x 10^{14}	15
Dielectric breakdown, Kv., short time dry	53
Wet	49
Step-by-step, dry	47
Wet	44

Readers' Service Item M-1

Three Stabilizers for Vinyls

Advance Solvents & Chemical, division of Carlisle Chemical Works, Inc., has introduced the following three stabilizers for vinyl resins:

Advastab CZ-11 is a white, fluid paste containing USFDA-approved, non-toxic compounds of barium and zinc. Intended for all calendering, plastisol, and extrusion operations where non-toxicity is of prime importance, the material weighs 7.2-7.3 pounds per gallon. Insoluble in most common solvents and plasticizers, it may be dispersed by simple grinding or milling.

For calendering, CZ-11 should be used in a concentration of 1.5%, based on resin content. Processing temperature should be kept below 350° F., unless USFDA-approved epoxy plasticizers are employed. A combination of 1.5% CZ-11 with 10 parts epoxy plasticizer has withstood 20-30 minutes at 360° F., in both clear and pigmented formulations.

Advastab BC-30 is a clear liquid combination of barium, cadmium, and zinc. Intended to enhance performance under extreme processing conditions where lubrication is not desired, it provides exceptional resistance to sulfide and copper staining. It is soluble in DOP, TOF, and epoxy plasticizers as 5% solutions. Gardner color index is 8, maximum, and the specific gravity is recorded at 1.045-1.055. Viscosity at 25° C., is reported at 600-650 cps.; refractive index, 1.482; and weight, 8.75 pounds per gallon.

Advastab BZ-51 is a clear liquid, barium-zinc compound which imparts complete freedom from hydrogen sulfide staining. Especially effective in conjunction with phosphate plasticizers and in heavily-filled and pigmented compositions, it offers optimum heat stability when used with Advastabs BC-74, BC-105, C-77, and C-79. Properties include a Gardner color index of eight, a specific gravity of 1.03-1.04, a viscosity of 400 cps., a refractive index of 1.485, and a weight of 8.65 pounds per gallon. It is soluble under the same conditions as BC-30.

Readers' Service Item M-2

Rigid Vinyl Plastisol

A low-viscosity vinyl plastisol which fuses to a Shore A hardness of 100 has been introduced by Rubber Corp. of America. Called R C Rigid Plastisol, the material is said to offer excellent rotational casting performance. Among its applications are lamps, manikin forms, art reproductions, fabric coatings, and tool handles.

Properties for the plastisol and fused film properties are reported as follows:

NOW... EMERY 3049-S

a new high mol.-wt. Polymeric Plasticizer that PROCESSES EASILY!

Emery 3049-S*, a new polymeric plasticizer, imparts all the extreme permanance properties to vinyl materials, yet processes easily on conventional equipment. In fact, 3049-S can be used as the sole plasticizer without incurring processing or compatibility difficulties.

Properties of 3049-S are those expected from the very high molecular-weight polymerics, i.e., extremely low volatility, excellent resistance to extraction and low migration. Emery 3049-S also possesses good electrical properties, excellent heat and light stability, and a combination of relatively low viscosity and good wetting that makes it an excellent vehicle for pigment grinding.

Because 3049-S can offer you more than other high molecular-weight polymerics, why not evaluate it in your vinyl formulations today? Write for sample or mail coupon below for descriptive literature.

Emery

Emery Industries, Inc.
Development and Service Department

Emery Industries, Inc.
Dept. Q 9-A, Carew Tower
Cincinnati 2, Ohio

Please send Development Product Bulletin on Emery 3049-S.

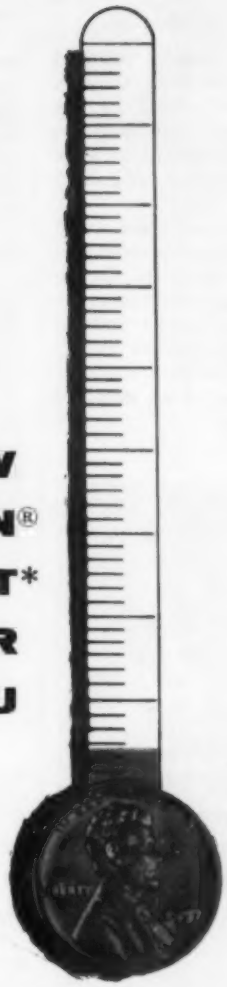
Name.....Title.....

Company.....

Address.....

City.....State.....

*Product in development stage



NEW PLASTOLEIN® 9078 LT* PLASTICIZER GIVES YOU

low-temperature flex and low cost!

Properties superior to adipates, yet in same price range

New Plastolein 9078 LT Plasticizer possesses an outstanding combination of properties that makes it very attractive as an economical low-temperature plasticizer. A unique product derived from Emery's Ozone Oxidation Process, Plastolein 9078 offers many advantages over the adipates, including better low-temperature flex, volatility, increased compatibility, lower mineral oil extraction, and higher efficiency.

If you are now using an adipate, check the advantages that Plastolein 9078 can impart to your product. Mail coupon below for descriptive literature, an evaluation sample, or a visit from one of our technical representatives.

*Low temperature

Comparison of Plastolein 9078 with di-decyl adipate

	Plast 9078	DDA
Parts Geon 101	100	100
Parts Plasticizer	48	49
Tensile, psi	2650	2400
Elongation, %	365	360
Modulus, 100%, psi	1130	1240
Hardness, D.10 sec.	85	89
Volatility, SPI, 70° C		
1 day-mg/in²	1.9	2.3
7 days-mg/in²	8.0	9.1
Masland Impact, °C	—40	Borderline at —40
Extraction, mg/in²		
Water, 24 hrs. @ 50° C	0.2	0.1
Soapy Water, 24 hrs. @ 50° C	1.0	0.4
Min. Oil, 24 hrs. @ 25° C	11.1	19.8
Compatibility, Roll Spew	Slight	Severe

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio, Dept. 0-9

☐ *Please* send descriptive literature on Plastolein 9078

☐ *Please* send a pint evaluation sample

☐ *Please* send a technical representative

*name*_____ *title*_____

*company*_____

*address*_____

*city*_____ *state*_____

Emery

Organic Chemical Sales Department

Emery Industries, Inc. Carew Tower, Cincinnati 2, Ohio

Viscosity, Brookfield, 20 rpm. @ 77°F., cps.	7,500
Solids, %	100
Specific gravity @ 25°C.	1.2
Color	Unlimited
Storage stability	Excellent
Tensile strength, psi.	2,700
Modulus, 100%, psi.	1,800
Elongation, %	200
Tear strength, Graves	470

Readers' Service Item M-3

Two-Step Phenolic Material

A fast-curing, two-step phenolic molding material has been introduced by Bakelite Co. Designated BMM-7000 Black 25, the material is said to provide reductions in cure time up to 50% as compared with the fastest one-step and two-step phenolics now on the market.

BMM-7000 is a woodflour-filled compound for use in general purpose moldings, particularly electrical components. Developed specifically for cold-powder automatic molding, it can be used with most types of molding equipment. Most plasticity grades are supplied in special low-fines granulations which can be preheated on standard equipment.

Curing speed increased with increased mold temperatures, and at 315° F., the material is as fast as a typical one-step material molded at 335° F. At the latter mold temperature, BMM-7000 has a modulus of elasticity of 50,000 psi., and a cure time of 50 seconds. To provide the same rigidity, a one-step material would require a 75-second cure; and a two-step material would need about 100 seconds.

The new material is said to retain mold details well and permit fast closing speeds. Finished products are free from the sink marks, usually associated with fast mold-closing materials. BMM-7000 is suitable for large moldings, having a greater latitude than the other fast-curing phenolics tested by plunger molding. It can be preheated over a wider range of preform temperatures and still give complete fill-out of the mold; however, to ensure the fastest cure speeds, electronic preheating times should be reduced. Recommended times are about 40% less than with the average one-step material; 20% less than for a typical two-step material.

Readers' Service Item M-4

VANSTAY Z

zinc bearing chelator for PVC resins imparts outstanding clarity, stability and resistance to sulfur staining when used as recommended with other VANSTAYS in many vinyl products.

Plastisols, Organosols, Extruded Goods

Use 1.5 VANSTAY R with .5 VANSTAY Z for maximum resistance to process heat and good service life.

Film, Sheeting, Molded Products

Use 1—1.5 VANSTAY HT with .5—1.5 VANSTAY Z to obtain the required protection.

When Roll plating is a problem:

Use 1.5 VANSTAY N with 1.5 VANSTAY Z as the stabilizing system.

Our Technical Service Representatives will gladly demonstrate the merits of our materials in your plant and assist in solving production problems.

Oliver

R. T. Vanderbilt Co., INC.

230 PARK AVENUE, NEW YORK 17, N. Y.

Primary Vinyl Plasticizer

A modified alkyl phthalate plasticizer for vinyl plastisols, electrical extrusions, and coatings has been developed by Pittsburgh Coke & Chemical Co. Called PX-313, the material can be used alone in high plasticizer: resin ratios without fear of incompatibility. Low-temperature flexibility is comparable to that obtained with the n-octyl-n-decyl phthalates, and PX-313 can be substituted in part to obtain equivalent low temperature properties.

PX-313 imparts good initial viscosity characteristics, is easily processed, and has a good shelf life. Its low volatility and excellent heat stability permit its use at higher than normal processing temperatures encountered in extrusion. It is compatible with cellulose nitrate, ethylcellulose, polystyrene, and most synthetic rubbers.

Properties are reported as follows:

Specific gravity	0.956
Color, max. APHA	50
Acidity as acetic acid, max. %	0.01
Ester content, min. %	99
Moisture, max. %	0.1
Ash, max. %	0.001
Odor	Mild
Refractive index	1.476
Pour point, °C.	—15
Flash point, °F.	435
Viscosity, cps., @ 25°C.	45.8
At 50°C.	15.1
At 75°C.	7

Readers' Service Item M-5

General Purpose Vinyl Resins

Three general-purpose PVC resins, featuring uniform particle size and unusually low fines, have been introduced by Escambia Chemical Corp. Designated Escambia PVCs 1200, 1225, and 1250, the materials are said to possess excellent free-flowing characteristics in hot premixes and dry blends.

Escambia PVC 1200 has a low molecular weight, a very low "fish eye" count, exceptional blending characteristics, excellent color, heat stability, and clarity. It can be calendered on standard equipment, or used with other resins to obtain reduced processing temperatures. Extrusion at substantially lower temperatures is possible, without increase in "fish eye" count. The material can be injection molded at low fill pressures and temperatures, and may be used with other resins to improve flow characteristics.

Escambia PVC 1225, an intermediate molecular weight resin, is intended for supported and unsupported film and sheeting. Its outstanding heat stability prevents color drift, and its low gel-particle content gives improved surface smoothness.

Escambia PVC 1250 is a high molecular weight resin intended for dry blend extrusion of shapes and profiles, as well as for calendered films. It has excellent blending characteristics, freedom from gel particles and superior heat stability.

Properties for the three resins are reported as follows:

	1200	1225	1250
Average relative viscosity, 1% cyclohexanone	2.03	2.25	2.45
Specific gravity	1.4	1.4	1.4
Bulk density, lbs./cu.ft.	35	33.5	31.5
Particle size, 40 mesh, % pass	100	100	100
Moisture content, %	0.5	0.5	0.5
Tensile strength, psi.	2,670	2,750	2,960
Modulus, 100%, psi.	1,870	1,920	1,940
Elongation, ultimate %	280	300	340
Hardness, Shore A	83-89	84-90	85-91

Readers' Service Item M-6

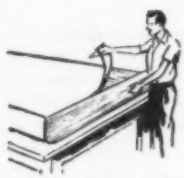
Concentrated Wetting Agent

A super-concentrated, neutral wetting agent for cleaning plastic, metal, glass and rubber is available from Merix Chemical Co. Designated Merix Wash Concentrate, the material is used prior to painting or metallizing to assure a spot-free surface. Since it contains no silicones nor other surface-changing elements, surfaces retain their usual adherence characteristics.

One gallon of the non-inflammable liquid is added to 100 gallons of water. The articles to be cleaned are dipped into this wash, removed, and allowed to dry.

Readers' Service Item M-7

Do you have a film casting RELEASE PROBLEM?



As a molding liner for polyurethane foam, Patapar does not "pit" the surface.

Excellent separator and core cover for rubber tape.

In the manufacture of polyester Fiberglas sheets, Patapar imparts satin-like finish.

Excellent as an interliner for cast films and "pre-impregs."

Patapar releases almost like magic

Cast adhesives, plastics and organosols release smoothly and easily from Patapar Releasing Parchments. Patapar will not absorb any of the cast material, and will give the released surface a smooth appearance.

Features include: fiber-free texture; high resistance to penetration or migration of oil and softeners; inertness to any surfaces they contact; permanent releasing action; rigidity or flexibility as desired; easily printable.

RECOMMENDED FOR:

Protective backing for pressure sensitive surfaces... Interleaver for pre-impregnated polyester Fiberglas ... Release backing for tacky shoe soles... Inner ply for multiwall bags for shipping tacky substances... Separator for uncured Neoprene... Release backing for gaskets and rubber caulking... Interleaver and core wrapper for rubber tapes... Casting sheet for organic adhesives, organosols and alkyd films... Interleaver for slab rubber... Casting sheet for polyurethane foams.

Samples and technical assistance freely available. Write us on your business letterhead.

Patapar®
RELEASING PARCHMENT

OTHER PATERSON PRODUCTS
*PATAX waxed paper
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PATERSON PARCHMENT PAPER COMPANY
Bristol, Pennsylvania
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HEADQUARTERS FOR VEGETABLE PARCHMENT SINCE 1885

New Equipment

Write item numbers on Readers' Service Card to obtain more information.

Model QM turbo-convection oven.

Hot Air-Convection Ovens

A line of Turbo-Convection Dyna-Ovens featuring full-muffle, forced convection and recirculation of hot air has been placed on the market by L & L Mfg. Co. Six standard models are available, with maximum temperature ranges of 225-1,000° F., and heating-chamber sizes of 4.75-27 cubic feet.

A temperature gradient of ±3° F., can be maintained, a unique feature in the low-price range. Operational parts include a fan, controller, fresh air inlet, exhaust vent, and Fiberglas or Rockwool insulation. Standard ovens have one shelf and one drip pan. Heating elements are fully concealed, thus offering no danger to personnel or load. All units are available with or without a stand, and are equipped to accommodate any of the standard AC or DC power sources.

Readers' Service Item E-1

Steel for Sharp-Angle Dies

A cutting rule steel which combines hardness and ductility has been introduced by Athenia Steel, division of National-Standard Co. It is used for making sharp angle- or intricately-shaped dies for cutting plastics, canvas, leather, and rubber. Hardness ranges from C36-C50, depending upon the desired ductility which, in turn, permits bending over radii of 0.025-0.125 inch.

Conventional cutting rules must sacrifice hardness so that they may be bent to shape. Athenia's material is reported to hold a cutting edge longer, cut a larger number of pieces per stroke, and assure a smooth-cut edge. A chemical analysis reveals the following constituency for the material: carbon, 0.6-0.7%; manganese, 0.6-0.9%; phosphorus, 0.03%; sulfur, 0.03%; and silicon, 0.15-0.3%.

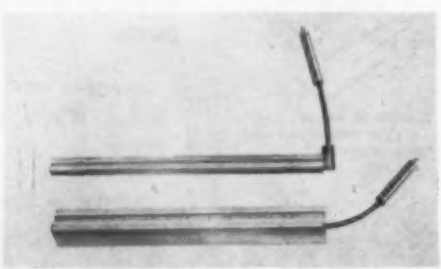
The material's structure is tempered martensite, and the edges are sheared or round. The steel is available in any length, in widths of ¾-1½ inches, and thicknesses of 0.028-0.042 inch. Maximum camber is ¼-inch for each eight-foot length.

Readers' Service Item E-2

Static-Eliminating Bar

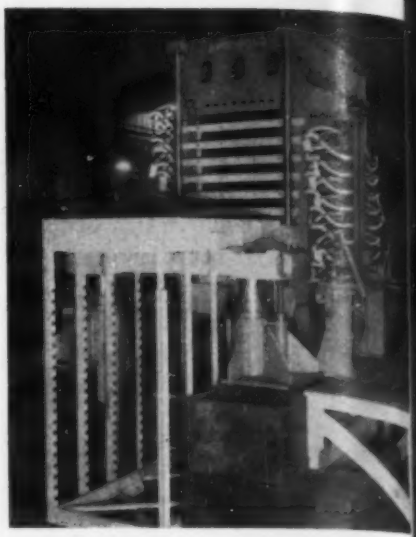
The Super Service Static Bar has been added to the line of static eliminating equipment available from the Simco Co. Square in cross-section, the totally-encased bar requires no maintenance other than an occasional brushing or blowing-off of the points. The bar cannot be short circuited internally, thus making it particularly adaptable to use in dirty locations.

Two cross-sectional sizes are available: ⅝-square inch in short and medium lengths up to 60 inches; 1¼ square inches in spans up to 12 feet. A complete static-eliminating system consists of one or more bars connected to a power unit. The bars are mounted across a machine in selected locations so that the material to be discharged passes near, but does not touch the bars.



Simco's new static eliminating bar.

Readers' Service Item E-3



Birdsboro's 2,200-ton laminating press.

Hydraulic Laminating Press

A multiple-opening, steam-platen press with side plate construction has been designed and built by Birdsboro Steel Foundry & Machine Co. Intended for the production of all types of laminated products, the 2,200-ton model features ease of loading and unloading through the multiple-opening elevator. When the press is open, the operator can unload the pressed product into the elevator and, by advancing the elevator one position, reload the press.

The side plates ensure a very rigid construction, and also hold deflection of the moving and top platens to a minimum. The main cylinders and top platen are heavy steel castings, keyed and bolted to the side plates. The steam plates are drilled for two inlets and two exhaust connections, thus ensuring even heating. A self-contained oil-hydraulic system can be provided, complete with automatic controls for operating the opening, closing, and holding periods during the cycle.

Rollers within the press area are retracted from under the loading plates just prior to closing the press. This eliminates the possibility of catching and damaging the plates. Roller retraction is actuated by a water-hydraulic cylinder-driven rack.

Specifications for the water-hydraulic model are reported as follows:

Movable platen size, in.	38 x 80
Distance between side plates, in.	46
Distance between platens, max. in.	77.75
Stroke, in.	36
Number of rams	2
Ram diameter, in.	34
Design operating pressure, psi.	2,500
Thickness of hot and cooling plates, in.	3.25
Heating and cooling plate size, in.	76 x 38
Number of openings	10
Opening size, in.	3.5

Readers' Service Item E-4

Deep-Throat Punch Press

A three-ton, bench-type press with a 12-inch throat, which can punch to the center of a 24-inch circle, has been introduced by Alva Allen Industries. Called the Allen Model BD-3, the unit can perform the following operations at speeds up to 300 per minute: punching, forming, blanking, cutting, drawing, shearing, and riveting. It can handle not only plastics, but metals, leather, fibers, textiles, and paper.

The press features a single-pin clutch with simple, positive, non-repeat or repeat action. All contact parts are heat-treated for maximum life, and the ram adjustment has a simple, positive lock. The straight ram guides assure accurate fitting of dies for precision stamping.

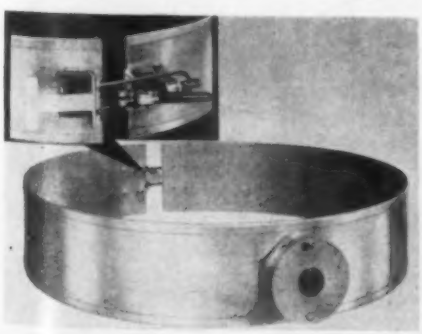
Standard stroke is ¾-inch; however, units with ¼- and 1½-inch strokes are available. The press weighs 182 pounds, and operates by V-belt drive with a ⅓-hp. motor. Foot-control, motor pulley, and bolster plate are standard equipment.

Bench-type press features 12-inch throat.

Readers' Service Item E-5

Band-Type Drum Heater

A drum heater designed to facilitate content removal from 55-gallon steel drums is available from Acra Electric Corp. Known as the RH-1 Acrawatt, the heater features a toggle clamp for fast application and removal, plus a built-in three-heat switch.



Drum heating band with close-up of toggle clamp.

At the high setting of 230 volts input, the heater delivers 3,000 watts or 10,236 Btu's of energy. The medium setting gives half the maximum wattage, and the low setting provides a 25% output. Actual heat inside the drum is reported at 65-85% of the total generated wattage, depending upon the condition of the container and the heat-absorbing properties of the contents. Concentration through the heater face is not sufficient to cause coking or burning of the contents.

Temperatures reached by the metal sheath are approximately 590, 350, and 175° F., at high, medium, and low settings, respectively. The clamping device can be separated from the bracket slots to increase size or to move over protrusions. The sheath or metal enclosure of the five-inch wide heater is aluminized steel, and the heat-generating resistors are nickel chromium insulated with sheet mica. The RH-1 is available in two capacities: 3,000 watts, as described above; and 2,500 watts.

Readers' Service Item E-6

"Colloid Corner" by COLUMBIAN

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When carbon paper receives the impact of the typewriter key, only a fantastically thin layer of wax-carbon dispersion is transferred to the copy paper. Yet this layer can provide the hiding power for clear, black reproduction . . . dramatic evidence of carbon black's ability to absorb the complete spectrum. Inks, paints and plastics are a few of the products which utilize this property of carbon black. Columbian Carbon Company can provide colloidal carbons with particle sizes from 9 to 90 millimicrons. These may have rough surfaces or smooth, high or low structure and controlled degrees of adsorption and absorption. All these qualities—and more—can be varied to custom-make a wide and useful variety of distinct colloidal carbons. Consult us about your application. Use our richness of experience—it is at your service. Or send now for our free technical booklet on properties of carbon blacks.

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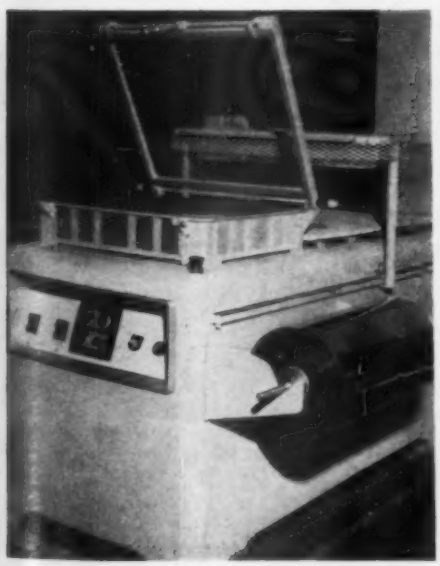
Granulator-loader operates beside the press.

Combination Granulator-Loader

A combination Shear-Way plastics granulator and Automatic Jet Loader has been introduced by Thoreson-McCosh, Inc. A compact unit, it is designed to return the material to the machine hopper while still hot and dry. This results in a considerable reduction of handling and labor costs.

No compressed air is used in the operation, thus reducing the possibilities of contamination as well as cost. All steel, it operates by shearing action with no "fluffing" of materials. Throat size measures 4½ by nine inches, and the standard screen size is ¼-inch. The four knives are powered by a 1½-hp. motor of the totally-enclosed type. The unit measures 18 by 30 inches, and is 58 inches high. Weight is approximately 450 pounds.

Readers' Service Item E-7



Model 30-0 skin packaging unit.

Plastic-Skin Packaging Unit

A skin-packaging machine called the Model 30-0 Plastic Packaging Machine has been introduced by Plastic Packaging Machinery Co., Inc. The operator places a printed, adhesive-coated, perforated card in the packaging box, places a sheet of plastic film over the items, closes the package box, pulls the heater forward, and approximately six seconds later pushes the heater to the rear and removes the finished item.

The package box measures 20 by 24 inches and has an adjustable depth from 1-4 inches. The heat cycle time on 5-mil butyrate film is calculated at five seconds, with a corresponding variance for film thickness and the type film used. The machine can package fragile items, since the amount of pressure exerted by the film is controllable.

A 6,500-watt infra-red heater, 100-gallon vacuum accumulator tank, and an automatic vacuum-exhaust valve are standard equipment. Floor space required for the unit measures 40 by 65 inches, and the maximum over-all height is 52 inches.

Readers' Service Item E-8

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RECIPROCATING HAND MACHINE

A rapid, accurate, easy-to-operate tool that saves costly hours on dies, molds and precision parts. Indispensable for filing, scraping, lapping and polishing operations involving flat or curved surfaces. Intricate details are finished in a fraction of normal time.

The Di-Profiler has a stroke adaptable from 0 to 6 mm. (¼"); reciprocation can be varied from 0 to 100 strokes per second.

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For complete details, write Dept. DA-97

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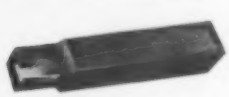
FOR FINER FINISHES FASTER ON DIES



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COST SAVINGS FOR MOLDS AND HOBS

New Products

Write item numbers on Readers' Service Card to obtain more information.

Fibrous glass-reinforced polyester signs.

Reinforced Plastic Signs

Glass-reinforced polyester signs, molded by Perry Plastics, Inc., are being used by the U. S. Fish & Wildlife Service to warn passers-by of electrically charged water. The electrically-charged lines are used to curb the breeding of lampreys, a parasitic eel-type fish which has been threatening the entire Great Lakes fishing industry.

The signs contain approximately 30% by weight of glass fibers, the rest being resin, filler, and coloring matter. The polyester resin used in this application is Laminac, a product of American Cyanamid Co. The signs have a tensile strength of 20,000 psi., and have the strength of steel at only one third the weight. Rust-proof, the signs are posted both on land and in the water.

In manufacturing the signs, Perry Plastics pours the resin over the glass mat which has been placed in a matched metal mold. The legends are applied by silk screen, and glass beading is applied for night reading.

Readers' Service Item P-1

PVC Pipe & Drainage Fittings

Complete PVC drainage systems for corrosive wastes are now available from Alpha Plastics, Inc. More economical and easier to install than cast iron, high-silicon iron, or ceramic lines, both pipe and fittings have smooth internal walls designed to provide optimum flow.

Alpha 101 PVC Schedule 40 is available in standard lengths of 10 and 20 feet, and in nominal sizes of 1½, two, three, and four inches. Molded, socket-type fittings can be obtained in the following styles: 90° long elbow, 90° short Y branch tee, 45° Y branch, T-Y cross, 90° short Y branch cross tee, coupling, 45° Y branch cross, and both socket-to-socket and socket-to-thread increaser bushings. The fittings are pitched ½-inch per foot to facilitate assembly.

The two-inch plastic pipe weighs only 1/10 as much as alloy cast iron. Since the latter is available in four-foot lengths, as opposed to the 20-foot lengths available in PVC, many more joints are required. It is estimated that each iron-oakum-leaded joint requires 22 minutes to complete, compared with one minute for the plastic joint.

The PVC drainage lines require no painting, and are unaffected by soil conditions and galvanic action. A special solvent cement, which can be applied with a paintbrush, is marketed by Alpha.

Basic materials for PVC drainage system.

Readers' Service Item P-2

Reinforced Plastic Wheels

All-plastic industrial wheels made from nylon-reinforced polyesters can be obtained from Fairbanks Co. Trademarked Lamilon, the wheels are said to feature particularly high impact strength and abrasion resistance. These properties enable the wheel to retain a smooth tread and perfect concentricity in service, thereby protecting the flooring against marking or marring.

Lamilon wheels will not absorb water, and are unaffected by oils and alkalis. Spark-proof, the wheels have load ratings of 260-1,450 pounds, depending upon size. Available wheel sizes range from three- by 1¼ inches to 12- by 3½ inches, hub lengths from 1½-4 inches, and axle sizes from ½-1¼ inches.

Nylon-reinforced polyester wheel.

The wheels are furnished with alloy-steel roller bearings and hardened-steel outer race. Provision is made for pressure lubrication. A special wheel with large-diameter thread guards is offered to the textile industry.

Readers' Service Item P-3

Precision-Made Plastic Lenses

Featherweight, unbreakable plastic lenses which can be optically-ground and polished to meet the most exacting requirements have been introduced by the industrial division of Optics Mfg. Corp. Spherical lenses are available in all standard sizes, and can be ground to specifications on short notice.

Other plastic lenses available from the firm are Fresnel lenses, with focal lengths ranging from 10-17½ inches and sizes up to 11 by 15 inches; and Lenticular screens with 60 lines-per-inch standard screens.

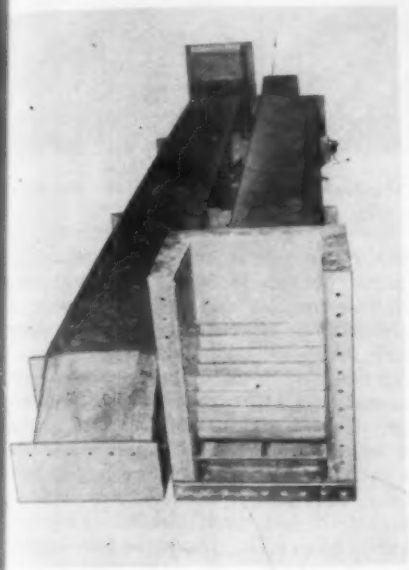
The plastic lenses are reportedly ideal as condensers, viewers, and grits or magnifiers for photographic and industrial equipment. The firm is engaged currently in the design of several lenses for microfilm reading, and production should be underway shortly.

Plastic lenses available from Optics Mfg. Corp.

Readers' Service Item P-4

einforced Plastic Elbow

A vaned, 90° elbow for incorporation o a corrosion-resistant fume duct system s been introduced by Haveg Industries, c. Manufactured from glass-reinforced lyesters, the vaned sections are available r both rectangular and circular systems. ey act by reducing turbulence and speed w for any angle turns in the duct system. Features include high corrosion resistnce and lightness. Field assembly is acmplished by means of bolted flanges or field welds. Net installed cost is reportly lower than for any other system fering comparable corrosion resistance.



Reinforced-plastic fume-duct elbows.

Readers' Service Item P-5

Reinforced Plastic Glazing

Flat sheets of fibrous glass-reinforced polyesters, press molded from three-ounce mat, available from Strick Plastics Corp. Called Glazor, the sheeting is available in sizes ranging from standard sash to 48 by 96 inches. Available colors include ermine white, daylight green, natural, light blue, and forest green.

Glazor reportedly will support 100 pounds per square foot on a four foot span, and cannot be damaged by welding sparks, burning cinders, or other ignited particles. Installable with regular woodworking tools, the glazing is especially suited for skylights, greenhouses, sidewalls, canopies, and factory windows.

Readers' Service Item P-6

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Molded polyethylene drum.

Disposable Polyethylene Drum

A disposable polyethylene drum, designed for use inside fiber and steel drums, has been developed by Delaware Barrel & Drum Co. Blow molded, both drum and closures are made at the same time without welds or seams. The plastic drum is supplied with any desired combination of filling and emptying closures, and is unaffected by corrosive materials.

The combination of plastic with a fiber drum offers great savings in weight, as well as ease of handling. This combination has received approval by I.C.C., O.F.C., and N.M.C. for shipment of 800 pounds, gross weight, of regulated and non-regulated products under test permit. At present, sizes are restricted to the 55-gallon unit; however, the firm plans to manufacture five-, 15-, and 30-gallon sizes in the near future.

Readers' Service Item P-7

Teflon-Coated Glass Fabric

A glass fabric-reinforced Teflon (Du Pont's tetrafluoroethylene resin) has been introduced by Chicago Gasket Co. Called Korda-Flex, the material shows a zero distortion under pressure and an extremely low distortion under combined heat and pressure. It remains pliable at temperatures below —100° F., and up to 390° F.

Teflon-coated glass fabric materials.

Dielectric strength varies from 250-1,500 volts per mil, short time, depending upon the thickness of the specimen. Power factor is less than 0.0007 over the entire range to 1,000 kilocycles. It provides electrical insulation protection in excess of Class H requirements.

Typical applications include slot liners, phase separators, armature lead support pads, coil insulation, gaskets, diaphragms, drum covers, and conveyor belts. Korda-Flex is supplied in standard 38-inch widths, but can be slit to as narrow as ¼-inch. Continuous lengths up to 100 yards can be provided. Standard thicknesses are 0.003-, 0.005-, 0.01-, and 0.015-inch; however, the material can be obtained as 0.01-0.125-inch laminates.

Readers' Service Item P-8

Vacuum-formed butyrate display halves.

Vacuum-Formed Display Piece

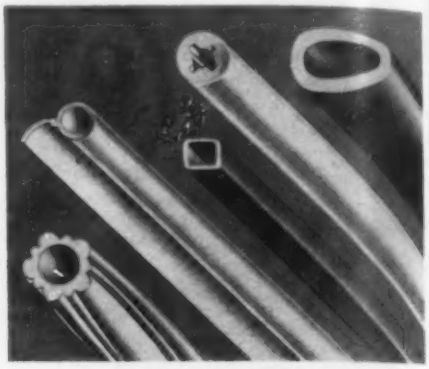
An illuminated display piece, vacuum formed from translucent white butyrate sheet by Herber Cooper Co., Inc., is being used on the windows of Union Oil service stations to advertise the latter firm's motor oil. The display consists of opposing halves, with each half decorated to resemble a can of oil.

Mounted on adhesive-type backings, the halves are adhered to opposite sides of the window. This gives the effect of a can of oil literally suspended within the window pane. Butyrate material used in the application is Tenite, a product of Eastman Chemical Products, Inc. The sheeting was extruded by Sanco Plastics.

Readers' Service Item P-9

Complex Custom Extrusions

Plastic extrusions to custom specifications are available from Anchor Plastics Co. There is no die charge for rods and tubes, regardless of diameter or wall thickness, and the small die and jig charge normally is absorbed by large production runs. Thermoplastic materials extruded by Anchor include acetate, butyrate, ethyl cellulose, regular and impact polystyrene, polyethylene, styrene-acrylonitrile copolymers, acrylics, and polyamides.



Complicated extrusions by Anchor are shown in cross section.

Curved sections, ellipses, cored extrusions, tracks, breaker strips, T-moldings, trims, handles, and trim are among the many complicated shapes which can be extruded by Anchor. Finishes include glossy, semi-glossy, matte, fluted, beaded, knurled, ribbed, and spiralled. They can be shipped as coils, spools, random lengths, or exact lengths.

Readers' Service Item P-10

Heat Sealable Tapes

A thermoplastic tape using polyester resin adhesives has been developed by G. T. Schjeldahl Co. Combining excellent bonding and dielectric properties, the tapes are strong, flexible, non-tacky, and will feed freely through automatic machinery for dyeing and heat sealing operations.

The tapes have been used successfully in laminating polyester films, wood, paper, glass, textiles, metals, and leather in various combinations. Sold in 330-foot rolls, they are available in three types: GT-100, a 250 gage without backing; GT-300, a 50-750 gage Mylar-backed tape coated on one side with adhesive; and GT-400, a 50-750 gage Mylar backing coated on both sides with adhesives. The backing may be either electrical grade or type-A Mylar.

Readers' Service Item P-11

New Literature

Write item numbers on Readers' Service card to obtain copies.

"Working With the Industrial Designer." Leotta & Parcher. 3 pages. The brochure contains eight suggestions enabling manufacturers to make better use of outside product-design services, and describes the company's concept of industrial design as a means to better marketing.

Readers' Service Item L-1

"Schwartz Research . . . The Difference in Adhesives for Plastics." Schwartz Chemical Co., Inc. 4 pages. This bulletin describes adhesives for bonding similar plastics, dissimilar plastics, or plastics to non-plastics; giving technical data on the properties, uses, and applications of seven cements developed by the firm.

Readers' Service Item L-2

"Ask Any Fair-Minded Man." American Arbitration Association. 15 pages. The pamphlet outlines, "what arbitration has done for others and what it can do for you." It describes the Association's function in providing impartial administration and maintaining panels from which parties may select arbitrators.

Readers' Service Item L-3

"Hysol." Houghton Laboratories, Inc. 11 pages. General information on the company's activities are given in this illustrated bulletin, as well as a description of their six basic product lines and services. These include epoxy resins, hardeners, castings, packaging, and engineering.

Readers' Service Item L-4

"Comparative Data on Hysol Tooling Materials." Bulletin T-1. Houghton Laboratories, Inc. 4 pages. Information on physical properties of cured systems, product description, applications, and characteristics of epoxy tooling materials is given. Types of resins for various industrial tooling applications are suggested.

Readers' Service Item L-5

"Bulk Storage of Polyvinyl Acetate Emulsions." Bulletin PVB No. 522. Colton Chemical Co. 4 pages. This bulletin discusses methods of shipment, storage, and handling of PVA emulsions as recommended by the company's engineering department.

Readers' Service Item L-6

"Custom Molded Plastics for Industry." Sylvania Electric Products, Inc. 12 pages. Featuring the theme, "What Makes a Good Custom Molder," this booklet contains illustrated sections describing the company's facilities for molding, finishing and assembly of components, research and development, and quality control.

Readers' Service Item L-7

"Polyester Resins Fact File." American Alkyd Industries. 9 pages. This folder describes nine basic Amester polyester resins which are available to reinforced plastics fabricators. It gives the type, typical liquid properties, and curing characteristics of each.

Readers' Service Item L-8

"Epoxy Paints With Thiokol Liquid Polymer." Thiokol Chemical Corp. 1 page. This bulletin describes the properties and uses of epoxy paints after the addition of Thiokol elastomeric liquid polymer. A sample metal strip sprayed with the polymer-treated paint is enclosed.

Readers' Service Item L-9

"Reduction of Tack in Pliovic AO Plastisols." Chemical Division, Goodyear Tire & Rubber Co. 4 pages. This pamphlet discusses the reduction of tack in AO plastisols by the use of the following additives: RCA Plasticizers TG-8 and TG-9, and Atomized Acrawax C. The test method is described and data are tabulated for comparison.

Readers' Service Item L-10

"Furane For Your Service." Furane Plastics, Inc. 4 pages. The scope of the company's services together with applications of their resins, coatings, sealants and adhesives, are summarized in this bulletin.

Readers' Service Item L-11

"Monsanto Polyethylene Data Sheets 12253, 12203, and 14202." Monsanto Chemical Co. 1 page each. These leaflets give property and performance information on three of the company's wire covering compounds. The first two enumerated materials are dielectrics, while the third is a jacketing material.

Readers' Service Item L-12

"Thermo Electric Selector Switches." No. 24-1. Thermo Electric Co., Inc. 4 pages. Key or push-button selector switches for thermocouple or resistance bulb circuits are described in this illustrated bulletin.

Readers' Service Item L-13

"Model 725, Automatic Compression Molding Press." Bulletin 201. F. J. Stokes Corp. 4 pages. This illustrated pamphlet describes the production, power, and physical specifications of the company's air-operated, 25 ton press.

Readers' Service Item L-14

"Stanpreg." Standard Insulation Co. 2 pages. This bulletin describes the company's polyester impregnated glass cloth and lists the properties of the general purpose and radio frequency types.

Readers' Service Item L-15

"Fiberfil." Fiberfil, Inc. 4 pages. Electrical, chemical, and physical properties of glass reinforced nylon and polystyrene injection molding compounds are listed in this booklet.

Readers' Service Item L-16

"Formica Commercial Interiors." Formica Corp. 8 pages. Decorative art such as inlays, silk screen patterns, and hand painted murals as applied to laminated plastic wall decorations are described in this booklet.

Readers' Service Item L-17

"Minimum Fusion Temperature of Plastisols Containing Barrett Plasticizers." C-573. Barrett Division, Allied Chemical & Dye Corp. 2 pages. Thermal properties of vinyl plastisols are discussed, and fusion temperatures of 15 types are tabulated.

Readers' Service Item L-18

"Short-Run Nylon Parts at Low Cost." Nylon Molded Products Corp. 4 pages. This bulletin discusses Process "N", which enables the short-run fabricator to deliver competitively 15,000-50,000 small nylon parts.

Readers' Service Item L-19

"Formulating With Medium Viscosity Vinyl Resin-Pliovic S70." Chemical Division, Goodyear Tire & Rubber Co. 1 page. This fact sheet suggests film, sheeting, and flooring formulations for injection molding compounds together with the resultant physical properties of each.

Readers' Service Item L-20

"Flo-Veyor for Transporting Granular Materials." Brady Conveyors Corp. 6 pages. Operating characteristics of a pneumatic system for moving dry pulverized and fine granular materials are discussed in this bulletin.

Readers' Service Item L-21

"Cycolac." Marbon Chemical, Division of Borg-Warner Corp. 9 pages. This illustrated brochure describes the physical characteristics and applications of a high impact thermoplastic resin.

Readers' Service Item L-22

"Durethene Polyethylene Film for Farm and Home Use." Booklet D-502. Chemical Division, Koppers Co., Inc. 23 pages. This booklet lists the farm and home uses of polyethylene film in addition to suggesting methods for cutting, taping, stitching, sealing, grommeting, and repairing it.

Readers' Service Item L-23

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Chemicals, Plastic Goods

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Book Reviews

"Symposium on Minimum Property Values of Electrical Insulating Materials." ASTM Special Technical Publication No. 188. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Paper, 6 by 9 inches, 48 pages. Price, $1.75.

The safety factor in electrical equipment design is based on the minimum accepted values for electrical and physical properties of the component materials. To provide the designer with a basis of predicting these minimum values, ASTM's Committee D-9 on Electrical Insulating Materials held a symposium on February 14, 1956, at which seven papers were presented. These papers, plus discussions of same, are included in this work.

Topics covered by the papers are as follows: "Significance of Minimum Property Values of Electrical Insulating Materials," "External Nature of Dielectric Breakdown-Effect of Sample Size," "Variability of Dielectric Breakdown in Sheet Insulation," "The Establishment of Minimum Quality Levels of Sheet Insulation," "Low-Temperature Resistance Test Methods for Non-Rigid Insulation," "Statistical Treatment of Heat-Aging Studies on Varnished Glass Cloth," and "Quality Level Cannot Be Determined by 'Go'-'No-Go'."

"Performance of Glass-Fabric Sandwich and Honeycomb Cores at Elevated Temperatures." V. C. Setterholm and E. W. Kuenzi, Forest Products Laboratory, U. S. Department of Agriculture for Wright Air Development Center. Order PB 121697 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 23 pages. Price 75¢.

This report describes the effects of high temperatures on the strength properties of heat-resistant glass-fabric sandwich and honeycomb cores, which are used as substitutes for structural frameworks in aircraft. The materials were subjected to flatwise compression and flexure tests after both short and long periods of exposure to temperatures of 75-700° F.

Compression and shear strength of cores treated with phenolics, silicones, and polyesters were found to decrease rapidly with the increase in temperature Cores treated with phenolics were strongest at all temperatures, and silicone-treated cores underwent the least reductions in strength due to temperature increase. The latter, however, were also the weakest. The best adhesive for bonding the cores to aluminum was a phenol-epoxy resin formulation containing about 20% clay. This was cured initially at 320° F., at a pressure of 20 psi. Post cure for 16 hours at the same temperature followed.

"The Chemical Industry Facts Book." Third Edition. Manufacturing Chemists' Association, Inc., 1625 Eye St., N.W., Washington 6, D. C. Paper, 6 by 9 inches, 159 pages. Price, $1.25.

A readable, over-all picture of the chemical industry in the United States, this book covers such generalized topics as its growth, how it operates, and the role of chemicals in everyday life. The industry's history, role in our economy and future are discussed along with its distinctive characteristics. Raw materials, workers, plants, finances, research, and development are covered.

A separate section is devoted to the role chemicals play in maintaining and restoring health, in agriculture, clothing manufacture, nuclear energy, and in defense. Appendices explain the Manufacturing Chemists' Association, its function, and its members. They also list trade organizations and technical societies concerned with chemical manufacturing and chemistry in general.

"Annual Report of Research for Use in ANC-17 Bulletin 'Plastics for Aircraft'." D. G. Coleman, Forest Products Laboratory, U. S. Department of Agriculture for Wright Air Development Center. Order PB 121695 from OTS, U. S. Department of Commerce, Washington 25, D.C. Paper, 14 pages. Price, 50¢.

A research program was instituted in 1956 for the development of reinforced plastic laminates for aircraft. Projects were designed to provide data for formulating specification requirements, and to furnish information for the designer of reinforced plastic parts. Data are related chiefly to laminates reinforced with glass fibers; however, many of the fundamental relationships should be applicable to laminates with other reinforcement. Abstracts of six technical reports issued during that year are included.

"Plastic Materials for Vision Devices—Formal Report No. 1." Order PB 121027 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 38 pages. Price, $1.00.

Three classes of plastic materials were investigated, and found to have abrasion-resistant properties better than methyl polymethacrylate and nearly as good as glass. They were methyl alpha-chloropolyacrylate and allyl diglycol carbonate, elastomers such as methyl polyacrylate and cross-linked polyesters, and coatings of silicon monoxide. Purpose of the tests was to find optical plastics with abrasion resistance approaching that of glass. The materials were to be used as laminates on the exposed surfaces of periscopes for combat vehicles.

"Plastic Materials for Vision Devices—Final Report." Order PB 121029 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 14 pages. Price, 50¢.

Two types of periscopes were prepared. In the first, silicon monoxide was applied as a protective coating for the vision surfaces of a methyl polymethacrylate periscope block. The mirror was provided by vacuum deposition of aluminum and overcoating the metal film with silicon monoxide. In the second model, both methyl polyacrylate and allyl diglycol carbonate were applied as laminated sheets replacing the glass in the periscope.

"Loaded Dielectric Foams." G. E. Niles, Emerson & Cuming, Inc., for Wright Air Development Center. Order PB 121897 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 51 pages. Price, $1.50.

Research was conducted to find a lightweight material of high dielectric constant for use in sandwich radome construction. Polyurethane foams, loaded with aluminum microflake, compared favorably with other radome core materials. Applied as a paste, the flaked aluminum was found superior to silver and nickel in increasing dielectric constants.

"High Temperature Resistant Sealant Materials." L. C. Boller and others, Coast Pro-Seal & Mfg. Co., for Wright Air Development Center. Order PB 121911 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 67 pages. Price, $1.75.

Objectives of the project were to develop fuel-tank sealants which would withstand fuel vapor temperatures to 540° F., and liquid fuel temperatures of 380° F., for limited periods of time. A formula was developed, which was unaffected by JP-5 jet fuel under these conditions.

Studies were made of the thermal stabilities of various, commercially-available, butadiene-acrylonitrile copolymers and phenolic resins. Some preliminary work was done with coatings based on aqueous dispersions of polytetrafluoroethylene, and test procedures were developed using Parr high-temperature apparatus.

Abstracts of Important Articles

Materials

"Tests for the Identification of Plastics and High Polymers," I. Ubaldini, *Ind. Plastiques Mod.*, 8, 8, 45 (Sept.-Oct. 1956).

A method of quantitative analysis is discussed which is based on personal experiments and critical examination of the usual procedures. The additives are separated from the base material by treating with suitable solvents and precipitation with ligroin, water, or the like. An alternative method is given for plastics which cannot undergo this treatment. The solvents used most generally for the different plastics are listed. After separation, the resin is subjected to a number of tests (to determine behavior to heat and flame, dry distillation, and heating in presence of sulfuric acid) to identify characteristic elements and groups, and also the various plastics. Tests and results are described. (In French).

"Plasticized PVC Compounds for Injection Molding," H. Sontag, *Kunststoffe*, 47, 1, 45 (Jan. 1957).

The preparation of plasticized PVC compounds for injection molding and their chemical and other properties are briefly considered in relation to applications. The processing conditions essential for success, the design of cylinders and injection nozzles, mold materials, finishing methods, etc., are given special attention. (In German).

"Coarse-grained PVC Polymers," M. Moreux, *Ind. Plastiques Mod.*, 9, 3, 48 (March 1957).

The advantages of the so-called "dry-blend" PVC polymers are outlined, as well as the following processing methods: milling, calendering, and extrusion. (In French).

"High Molecular Weight Ester Plasticizers—Classification, Composition, Evaluation and Technological Properties," K. Zohrer and A. Merz, *Kunststoffe*, 47, 3, 102 (March 1957).

The various high-molecular-weight (600-8,000) ester plasticizers are classified, and their technological properties are compared and tabulated. They are divided into five groups: sebacic acids, adipic acids, phthalic acids, plasticizers of unknown compositon, and epoxies. A series of Reoplex plasticizers is considered separately. Admixtures of dioctylphthalate and dioctylsebacate with sebacic acid, adipic acid, phthalic acid and epoxy plasticizers in PVC Lonza G, are described, along with a simple, quick method for evaluating end products. (In German).

"Polyvinyl Ethers," G. Boffa, *Mat. Plastiche*, 22, 1, 73 (Jan. 1957).

The method of preparing polyvinyl ethers and their uses are followed by notes on two new alkyl-vinyl ether polymers produced by Union Carbide Corp. Lutanol and Oppanol types, produced by Badische Aniline u. Soda Fabrik, Germany, also are considered. (In Italian).

"Thermal Stabilization of Chlorinated Resins by the Antichlor Action of Epoxy Compounds," E. Savelli, *Mat. Plastiche*, 22, 1, 27 (Jan. 1957)

Properties, the antichlor action of epikote resins in general, and the synergic stabilizing action of Epikote 834 (Epon RN 34) are considered. Geon 101 and Vinylite VYNW, stabilized with various types of Epikote 834, were tested and compared with Vennels' studies on doubly-stabilized compounds. (In Italian).

"Studies on Identifying the Benzene Ring in Macromolecules of Plastics," J. Henniker, P. Dubois, L. Jacque and A. Giger, *Ind. Plastiques Mod.*, 9, 3, 38 and 9, 4, 47 (Mar. and April 1957).

The benzene ring in macromolecules of plastics is identified by infrared spectrometry. Characteristic frequencies of the benzene ring are given for a number of polymeric materials, including such little-known compounds as phthalic polyesters, two types of aniline-formol, two epoxylines, a silicone, some coumarone indenes, salicylic polyacid, and a polyurethane. Absorption spectra are also presented along with explanations. (In French).

"The Limitations of Polyamides," W. Laeis, *Plastverarbeiter*, 7, 12, 446 (Dec. 1956).

Ignorance of the limitations of polyamide plastics has led to many disappointments in performance, and scepticism is beginning to take the place of early enthusiasm for nylon and perlon fibers. The author reviews the properties, structure, water absorption, contraction, and tolerances of polyamide plastics, and gives examples of their correct applications. (In German).

"The New Types of Polyethylene," E. Fachnelli, *Poliplasti*, 4, 17, 25 (Sept.-Oct. 1956).

A general description and classification of the principal polyethylenes now used in industry is given. This includes polyethylenes of low, high, and intermediate density, and irradiated polyethylenes. Applications for the newer materials are mentioned. (In Italian).

"Polyvinylacetate, Plastisols, and Organosols," W. Riese, *Kunststoffe*, 47, 3, 116 (Mar. 1957).

The production of polyvinylacetate plastisols, organosols, and plastigels is described along with their use in coating metals and paper, improving textiles, chemproofing surfaces, and as foamed articles. (In German).

"Comparative Investigation of Plastic Foils for Packaging Cosmetics, with Special Reference to Tubes," G. Mylius, *Plaste u. Kautschuk*, 3, 10, 224 and 3, 11, 262 (Oct. and Nov. 1956).

Thin, unplasticized foils such as Perfol (superpolyamide), cellophane, polyethylene, Hostaphan, cellulose triacetate, polystyrene and PVC, were examined to determine their usefulness as insulating linings for plasticized PVC containers. Simple tests on swelling in water and essential oils, water permeability, diffusion of oxygen, and reaction to 50%-alcohol perfume solutions showed that Hostaphan, rigid PVC, and triacetate cellulose, in that order, were particularly suitable. (In German).

"Impact Testing of Toughened Polystyrene," G. Hulse and W. Taylor, *Brit. Plastics*, 30, 2, 66 (Feb. 1957).

No existing impact test meets all the increasingly difficult requirements of such a test; however, until this has been achieved, the best available technique involves use of the notched Izod impact for toughened polystyrene.

"Determining Degree of Cure in Phenoplastic Moldings," R. Thater, *Plaste u. Kautschuk*, 3, 11, P. 1 (Nov. 1956).

Test-cup and acetone-extraction methods for determining the degree of cure in phenoplastic moldings are described (In German).

"Adhesion Strength of Plastic-Bonded Metal Assemblies," I. Bursztyn, *Plaste u. Kautschuk*, 3, 11, 261 (Nov. 1956).

The article measures resistance to water and solvents, as well as the peeling strength of parts made from Polish duraluminum

bonded with the following plastic adhesives: epoxy resins, Karbinol (polydimethylvinyl propionol) polyvinyl butyral, and polyvinyl formal modified with phenolformaldehyde resins. The tests were conducted at the Warsaw Plastics Institute to determine the assemblies' value in aircraft construction. (In German).

Equipment

"Silicones in the Plastics Industry," L. P. Piantanida, *Poliplasti*, 4, 18, 10 (Nov.-Dec. 1956).

Silicones are used in the plastics industry as mold-release agents, molding powder, foamed material, and in laminates. Their use as adhesives and as additives to improve the properties of polystyrene and PVC, also is covered. (In Italian).

"New Method for Making Foundry Molds with the Aid of Synthetic Resins," H. Kalpers, *Plastverarbeiter*, 7, 12, 453 (Dec. 1956).

The Croning patents covering the method and equipment for casting shell molds for foundry work, using synthetic resins as binders for the sand, are discussed; along with the more recent German developments in procedure, machinery and application (In German).

"New Perspectives in Plastics Research Offered by Magnetic Nuclear Resonance," A. Sandri, *Poliplasti*, 4, 17, 21 (Sept.-Oct. 1956).

Recently-perfected, high-resolution apparatus permits the use of magnetic nuclear resonance in plastic research. The principles involved, methods, and applications are discussed for the Varian high-resolution and variable-frequency spectrometers. (In Italian).

"Standardization of Molding Compounds and Testing of Phenolic and Aminoplastic Molding," K. Karschunke and H. Mandler, *Plaste u. Kautschuk*, 3, 10, 349 (Oct. 1956).

East German apparatus necessary for carrying out tests to meet DIN 7708 standards are shown, and the standards explained. (In German).

"Simple Nitrometer for Determining Urea," N. Grandis, *Mat. Plastiche*, 22, 1, 54 (Jan. 1957).

A simple apparatus for the rapid and economical determining of the urea content of aqueous solutions is described. These solutions are used to plasticize regenerated cellulose. The apparatus employs the gasometric method, with sodium hypobromide decomposition of the urea. It also can be adapted for use as a calcimeter. (In Italian).

"Thin-blown PVC Film," A. Trevisan, *Poliplasti*, 4, 18, 18 (Nov.-Dec. 1956).

The machinery required for producing thin, blown film is described, with special references to a recently-patented Solvic vertical extruder. (In Italian).

"Electronic Welding in the Manufacture of Garments," J. Blond, *Mat. Plastiche*, 22, 1, 36 (Jan. 1957).

Equipment used in the production of welded plastic raincoats, jackets, baby pants, and garment bags is described. Details of the operations, and the types and prices of electrodes required are tabulated. (In Italian).

Processing

"Screen Printing," Messerschmidt (No initials given), *Plastverarbeiter*, 7, 12, 461 (Dec. 1956).

The screen process for printing on

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"Chemical and Engineering News"
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Washington 6, D. C.

"Hule Mexicano y Plasticos"
Filomeno Mata 13-11, Mexico, D.F.

"Industrial and Engineering Chemistry"
1155 Sixteenth St. N.W.
Washington 6, D. C.

"Industries des Plastiques Modernes"
Les Publications Techniques Associees
40 Rue du Colisee, Paris 8e, France

"Kunststoffe"
Carl Hanser Verlag
Leonard Eck Str. 7, Munich 27,
Germany

"Kunststoff-Rundschau"
Brunke Garrels, Verlagsbuchhandlung
Borgfelder Strasse 83, Hamburg 26,
Germany

"Materials and Methods"
Reinhold Publishing Corp.
430 Park Ave., New York 22, N. Y.

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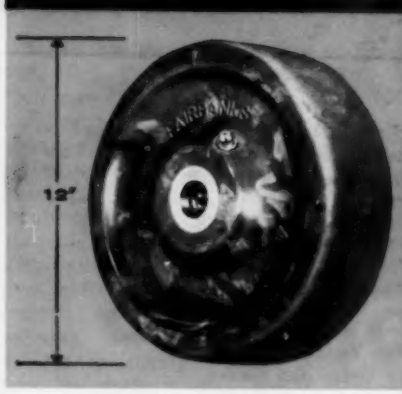

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plastics is described, along with its applications and limitations. (In German).

"Lining Metal Pipe with Rigid PVC Film," H. Wippenbahn, *Kunstoffe*, 47, 5, 281 (May 1957).

When high mechanical demands preclude the use of PVC pipe, metal pipe lined with rigid PVC sheet can be used with good results. The methods of shaping the plastic sheet with the aid of a split pipe of fibrous glass-reinforced polyester resin, plus methods of introducing it into the metal pipes are described. (In German).

"Advances in Forming Thermoplastic Plates," G. Matulat, *Kunstoffe*, 47, 5, 291 (May 1957).

Among the vacuum forming developments described in this article are the combination of different processes for producing large parts, the use of pre-forming dies, and pneumatic pre-stretching and forming. Information is given on suitable materials, and on the type and arrangement of suction holes. (In German).

"Blown Extrusion of PVC," R. G. Huret, *Ind. Plastiques Mod.*, 9, 5, 32 (May 1957).

A review of method, equipment, and materials used in the blown extrusion process is given, along with an evaluation of the final products. (In French).

"Application of the Holofol Process," W. Opavsky, *Plastverarbeiter*, 7, 12, 458 (Dec. 1956).

This is a continuation of a series of articles on applications of the process, several having appeared in earlier issues of the same publication. The author discusses its possibilities in the production of seamless articles from PVC film. (In German).

Applications

"Cellulose Acetate Butyrate Pipelines," W. Rohm, *Kunstoffe*, 47, 5, 285 (May 1957).

Butyrate compounds are being used now in West Germany for the production of pipe lines. At present, their use is restricted to inserts in metal pipes which are used to convey crude oil. (In German).

"The Rayon Industry's Influence on the Development of Special Thermosetting Plastics," A. Beecham, *Plastics (London)*, 22, 232, 28 (Jan. 1957).

With the exception of nylon-filled materials, thermosetting resins are the only plastics which have answered the special requirements of plastic parts for the rayon industry. The materials themselves, their development, specific applications, and molding problems are discussed.

"Applications of Polyvinyl Acetals in the Industry," W. Muhlsteph, *Plaste u. Kautschuk*, 3, 10, 233 (Oct. 1956).

A discussion of the properties of polyvinyl acetals is followed by a listing of applications in the varnish and paint industries, floorings, adhesives, textile finishes, and as binders in the manufacture of artificial leather. Uses of polyvinyl alcohol (obtained by saponification of polyvinyl acetals) are touched upon. (In German).

"Glass Fiber Reinforced Plastics in Road Transport," H. V. Blake, *Plastics (London)*, 22, 232, 18 (Jan. 1957).

Problems involved in the use of fibrous glass-reinforced plastics in the construction of vehicles are discussed, along with applications in the British motor vehicle industry. Sports cars, buses, light trucks, tank trucks, ambulances, and trailers are covered.

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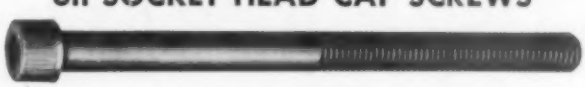

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Patent Digest

Materials

Resinous Compositions. No. 2,773,848 Richard Lindenfelser, Darien, Conn. (to American Cyanamid Co., New York, N. Y.).

The composition consists of a thermosetting reaction product of an aldehyde and a monomeric amidogen compound. The reaction product is modified with alpha-D-glucoside, wherein the alkyl group contains from one to four carbon atoms, and the gulcoside is present in an amount varying between 10-30%, by weight, of the entire reaction product.

Production of Anti-Static Plastics. No. 2,773,852. Richard G. Rowe, Redding Ridge, and Guiles Flower, Jr., Darien, Conn. (to Dictaphone Corp., Bridgeport, Conn.).

An anti-static plastic for the production of phonograph records composed of a copolymer of vinyl chloride and vinyl acetate, and containing from 2-10% by weight of a mono-alkanol amide of a straight-chain mono-carboxylic hydroxy acid, which serves as an anti-static agent.

Resinous Compositions Comprising Thermosetting Epoxide Resins and Thermoplastic Polyvinyl Resins and Bentonite-Amine Reaction Products. No. 2,773,043. Florian J. Zukas, Forest Hills, Pa. (to Westinghouse Electric Corp., East Pittsburgh, Pa.).

A hardenable, normally-liquid resinous composition containing 20-80 parts by weight of a glycidyl polyether of a polyhydric phenol is mixed in the presence of a catalyst, with 80-20 parts by weight of a thermoplastic resin composed of a plastisol and a bentonite-amine reaction product in an amount sufficient to maintain the catalyst in suspension. The resulting composition is converted to a homogeneous solid having excellent flexibility characteristics and impact resistance.

Method of Evaluating Polymerized Vinyl Chloride Systems. No. 2,773,746. Harold A. Reehling, Lancaster, Pa. (to Armstrong Cork Co., Lancaster, Pa.).

A method of testing stability of a resinous system containing polymerized vinyl chloride against heat and light degradation consists of incorporating ultramarine blue into the system, and exposing the resulting mixture to degradation conditions. The degree of stability is estimated by the color change in the exposed mixture.

Production and Use of Acrylonitrile Polymer Solutions. No. 2,781,243. John Downing, Arthur Hodge, and James Gordon Naprier Dewitt, Spondon, England (to British Celanese Corp., Ltd.).

Compositions of an acrylonitrile polymer whose molecule contains more than 50% by weight of acrylonitrile dissolved in a mixture of nitro-methane and a mono-substituted acetic acid.

Method of Treating Benzyl Cellulose. No. 2,781,276. Walter E. A. Simon, Kiel-Wellingdorf, Germany. (to Brycel, Ltd., Hackbridge, England.).

Benzyl cellulose may be treated to prevent the formation of bubbles and pores by heating to a flowable condition and mixing with a phenol in the presence of an alkaline catalyst.

High Impact Strength Plastic Composition Containing Polyvinyl Acetal Resin and Ethyl Acrylate Elastomer. No. 2,775,572. Charles F. Fisk, Clifton, N. J. (to United States Rubber Co., New York, N. Y.).

About 5-20% by weight of an ethyl acrylate elastomer is blended intimately with 95-80% of a polyvinyl acetal resin to form a hard, tough, thermoplastic mixture having an Izod impact strength of at least four foot-pounds per inch of notch and a flexural modulus in excess of 100,000 psi. The resin must be derived from a polyvinyl acetate, 75% of whose acetate ester groups have been replaced by aldehydes.

Thiocyanated Hydrogenated Diene Polymers and Process of Producing the Same. No. 2,781,331. Rufus V. Jones and Peter J. Canterino, Bartlesville, Okla. (to Phillips Petroleum Co., Bartlesville, Okla.).

The thermoplastic material comprises a conjugated diene polymer having 4-6 carbon atoms and a small amount of a copolymerizable monomer containing an active vinylidene group. The polymer, having been hydrogenated to produce a material with an unsaturation in the range from 2-50%, is thiocyanated to produce another material containing 5-30% by weight of thiocyanogen.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

Manufacture of Filamentary Material From Copolymers of Acrylonitrile and Vinylidene Chloride. No. 2,775,507. John Downing and James Gordon Napier Drewitt, Spondon, England. (to British Celanese Corp. Ltd.).

An acetone solution of a binary copolymer of acrylonitrile and vinylidene chloride is extruded into a coagulating bath consisting of at least 83% by weight of aliphatic hydrocarbon material.

Plasticized Cellulose Compound and a Sheet Made Therefrom. No. 2,782,127. Eric Eaton Walker, Wilfred Rogerson Foggon, Ronald Stanley Locks, and Micheal Pearman Shaw, Spondon, England. (to British Celanese Corp., Ltd.).

Coloring matter is added to a cellulose derivative that has been plasticized by a halogen-containing plasticizer. Since the colorant's rate of fading is accelerated by the plasticizer, a small amount of an alkali metal salt of benzene carbozylic acids and their homologues is added.

Manufacture of Etherified Melamine-Formaldehyde Resins. No. 2,781,332. Geoffrey Swann, Hunts Cross, Liverpool, and Peter G. A. Evans, Childwell, Liverpool, England. (to Reichold Chemicals, Inc., Detroit, Mich.).

The condensation product of melamine and an aqueous solution of formaldehyde in the presence of an alkaline catalyst is condensed further with an unsubstituted, saturated, monohydric, aliphatic alcohol. This second condensation is catalyzed with an acid. The initial reacting ingredients are present in the ratio of 3.5-7 moles of aqueous formaldehyde and 4.5-7 moles of alcohol per mole of melamine.

Divinyl Aromatic Modified Isoolefin-Multiolefin Copolymers. No. 2,781,334. Lester M. Welch, Madison, Howard L. Wilson, Raritan Township, Middlesex County, and Luther B. Turner, Cranford, N. J. (to Esso Research and Engineering Co., New York, N. Y.).

About 99-99.5% by weight of an iso-olefin, 0.5-30% of a conjugated aliphatic diolefin, and from 0.1-0.8% by weight, based on the amount of iso-olefin used, of divinyl benzene are copolymerized at a temperature between minus 164° C. and 0° C., by the addition of a dissolved Friedel-Crafts catalyst.

Equipment

Machine for Classifying and Separating Materials. No. 2,774,476. William T. Doyle. Boston, Mass. (to Sturtevant Mill Co., Boston, Mass.).

A centrifugal separator consists of a casing with a feed inlet for receiving finely divided material; a material classifier system mounted within the casing; a fan located above the classifier mechanism to induce the flow of air up through the classifier; and upper and lower conduits for guiding material along reversely-directed, spiralling paths. The classified material is released selectively through a discharge outlet in the casing.

Molding Apparatus. No. 2,774,989. Peter Crammond, Ruislip, and John Ernest Denney, Belvedere, England. (to Warner-Hudnut, Inc., New York, N. Y.).

The apparatus consists of a heating jacket surrounding a chamber for holding molten thermoplastic material. A number of pouring spouts, open at each end, extend through the heating jacket from the bottom of the chamber. Their upper ends form seats for the plug valves carried by upwardly-extending valve stems. The latter are slidably supported by a carrier plate disposed within the chamber and which is slidably supported by a lever. Both the plate and the valves are provided with a spring means to secure their proper positioning.

Molding and Dispensing of Plastic Materials. No. 2,774,104. Bruce D. Miller, Louisville, Ky. (to National Cylinder Gas Co., Chicago, Ill.).

A machine for molding and dispensing plastic material consists of a mold adapted to receive the plastic material; a conveyor arranged for step-by-step advance past the mold outlet; means for expelling a predetermined quantity of plastic material from the mold; a cutting means, movable across the outlet for detaching the expelled material; and a means for lifting the conveyor into adhesive contact with the plastic. This prevents deformation during the advancement of the conveyor.

Extraction-Extrusion Apparatus. No. 2,774,105. Ernest C. Bernhardt, Montclair, N. J. (to E. I. du Pont de Nemours and Co., Wilmington, Del.).

The apparatus, designed for the removal of a volatile component from a mixture of a plastic material, consists of a cylindrical barrel, a helical screw conveyor mounted therein, and a means for driving the conveyor. The screw has a zone of greater drag-flow capacity following a throttling zone of lesser drag-flow capacity; a hollow core communicating with the former zone; and a means of

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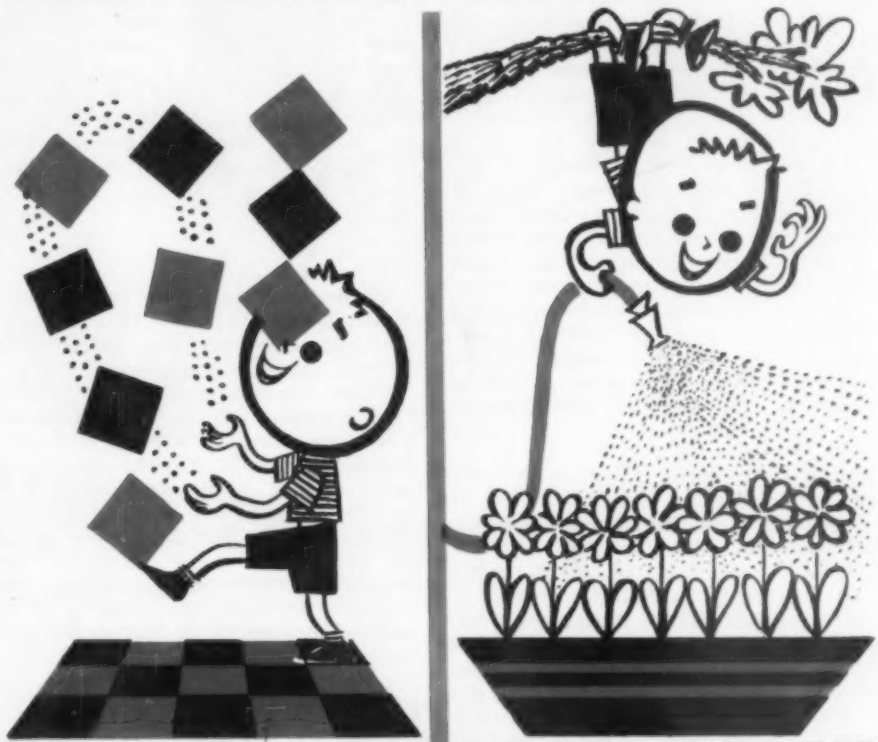

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applying a vacuum. The core is positioned in the forward half of a channel between threads in the greater drag-flow zone.

Die Construction for Pressure Injection Molding Machines. No. 2,773,284. George W. Kelly, Columbus, O. (to Columbus Plastics Products, Inc., Columbus, O.).

The die comprises a passage terminating in a discharge orifice and embodies a plurality of angularly disposed branches. It includes an injection means for forcing plastic material through the passage; a sprue cut-off pin movably mounted in axially-spaced relation to the injector and normally extending into the passage in spaced relation to the discharge orifice; a lever, pivotally-mounted on a die is connected to the pin and moves it in the general direction of material flow; and a cylinder mounted on the die, containing a fluid-actuated piston. The piston carries a rigid rod extending to the exterior of the cylinder where it is connected to, and actuates the sprue cut-off pin moving lever.

Machine for Melting and Feeding Solidified Materials. No. 2,773,496. John D. Czarnecki, Oak Park, Ill. (to American Can Co., New York, N. Y.).

The machine receives thermoplastic material in a hollow cylinder, an open end of which is adjacent to and communicates with a grid heating element. The open end is constricted to grasp the material and form a seal between the grid element and cylinder. The element contains a number of passages through which the heated material can flow, while a cooling means surrounding the cylinder at the restricted end keeps portions of the material remote from the grid in a solid state.

Processing

Method of Making a Laminated Structure. No. 2,773,792. Robert J. Nebesar, Bristol, Tenn. (to Universal Moulded Products Corp., Bristol, Va.).

The method consists of forming a resin-impregnated fabric spar and molding it together with cellular plastic. The spar and plastic are subsequently surrounded with a pair of resin-impregnated fabric sheets and remolded within the same mold to form a unitary structure.

Vinyl Plastic Tile and Method of Making Same. No. 2,773,851. Leo L. Tolman, Manor Township, Lancaster County, Pa. (to Armstrong Cork Co., Lancaster, Pa.).

A plastic tile composition comprising, by weight, 60-80% filler and 20-40% binder, includes a vinyl chloride resin; a coumarone or hydrocarbon resin having a ring and ball softening point between 95-105° C.; a resinous, dihydric alcohol-dicarboxylic acid condensation product; and a plasticizer.

Method of Producing Plastic Rim Spools. No. 2,774,398. Louis H. Morin, Bronx, N. Y. (to Coats & Clark, Inc., Pawtucket, R. I.).

A spool body, mounted on a mandrel, is disposed at an acute angle to the surface of a settable coating liquid. A corner of the flange is submerged in the fluid and the mandrel is rotated to apply a ring-like deposit on the flange. The spool body is raised above the level of the fluid while still rotating. The plastic material is set, and a cut through the deposit is made to form a non-chippable, thread-holding nick in the flange.

Method and Apparatus for Processing Plastic Tubing. No. 2,781,589. Richard E. Cornwell, Claymont, Del. (to American Viscose Corp., Philadelphia, Pa.).

Plastic tubing is continuously processed by conducting it, in opened form, through a treating zone. A treating medium is supplied as small, confined streams directed toward points immediately adjacent the inside surface of the tubing wall. These discharge into the tubing, striking the wall surface in a solvent-free condition. The treating medium is distributed uniformly by continuous rotation of the confined streams. After leaving the treating zone, the tubing is slit.

Method of Making Laminated Tubing. No. 2,783,173. Benjamin M. Walker, Caldwell, and Alexander N. T. St. John, Glen Ridge, N. J. (to Resistoflex Corp., Roseland, N. J.).

Reinforced fluorocarbon pipe is made by wrapping on a mandrel layers of resin-impregnated fabric and covering same with a tightly wrapped layer of glass-fabric tape. The assembly is heated to sintering temperature, this fusing the adjacent resin surfaces of the fabric. When the assembly is cooled, the tape is removed, and the pipe may be taken from the mandrel.

Method of Manufacturing Plastic Pipe. No. 2,773,287. William H. Stout, Portland, Ore.

A mat of glass fiber is disposed against and around the inner surface of a tubular member which is rotated about its longitudinal axis. A thermosetting resin and a quantity of granular sand-like materials having a specific gravity higher than that of the resin are successively deposited within the rotating member. Centrifugal force causes the granular material to exert pressure against the fibers while the resin infiltrates the spaces between them. Heat is applied to cure the resin while still in rotation. A high-strength plastic pipe is thus formed, with the outer portion enriched in glass fibers dispersed as a plurality of layers throughout the resin, and an inner portion enriched in resin-bonded granular material.

Method of Vacuum Forming Ductile Material. No. 2,781,077. Chester A. Dovidio, Leominster, Mass. (to Nixon Nitration Works, Nixon, N. J.).

Thermoplastic sheet material is formed about a contoured object by placing said object in an enclosure; covering the enclosure with the sheeting so as to render it air-tight; applying heat to soften the thermoplastic; and applying a reduced vacuum to the inside of the enclosure to draw the sheet into contact with the object about which it is to be formed. The heat source is removed and full vacuum is applied to the enclosure for the remainder of the drawing operation.

Method of Making Hollow Containers. No. 2,781,551. Louis J. Richerod, Adrogue, Argentina.

A hollow tubular member is formed by compressing together sheets of polyethylene and plasticized vinyl resin, the latter having a slightly higher softening point than the polyethylene. The composite mass is formed into a tube, with the polyethylene inside, and heated. The tube is expanded by internal fluid pressure, stretching the vinyl resin to shape, while retaining an internal surface coating of polyethylene. The two substances unite to form a substantially integral sheet, so that the tubular member will remain flexible with no tendency for the layers to separate in use.

Method of Making Sterile Containers. No. 2,773,285. Thomas E. Piazze and Thomas R. Baxter, Mount Vernon, O. (to Continental Can Co., Inc. New York, N. Y.)

A thermoplastic material, extruded in the form of a hollow tubular body, is sterilized by a hot fluid medium supplied to its interior. It is flattened to remove the fluid, and sealed at spaced intervals to provide a plurality of integrally connected containers. These are adapted to remain free of internal contamination until they are individually severed.

Applications

Driven Plastic Sealing Fastener Having Shoulder Means Thereon. No. 2,780,128. George M. Rapata, Chicago, Ill. (to Illinois Tool Works, Chicago, Ill.).

A one-piece plastic drive fastener for securing together spaced aperture panels of a work structure comprises a head having a clamping surface for engaging one surface of the work structure; a driving head; and a rigid shaft extending axially from the clamping surface. The shank, which has a plurality of integral, axially-spaced shoulders, is provided with an elongated, tapering free-end portion to

facilitate driving it through the material. It encloses a recess that axially traverses the shoulder section and lends resiliency in that area. The design of the shank and recess is such as to facilitate resilient collapse of the shank section during insertion. After clearing the panel, the shank expands beyond the work structure to position a radial surface of a shoulder, and engage the work structure in opposition to the clamping surface of the head.

Ornamental Article. No. 2,781,597. Harry C. Doane, Flint, Mich. (to General Motors Corp., Detroit, Mich.).

A layer of transparent plastic material is molded around a shaped core member having a through-opening. A recessed portion registers with the shaped opening to provide a cavity. An ornamental insert permanently secured within the cavity gives a three-dimensional appearance when viewed through the transparent plastic layer.

Ventilated Plastic Bag. No. 2,774,402. Richard H. Wikle., Atlanta, Ga.

The bag is made of plastic sheet material with an imperforate border portion enclosing and separating the perforate sections which make up the side walls of the bag. A perforate section comprises a plurality of filaments which are integrally connected in a manner to form ventilating openings. The sheet is joined together at opposite portions and sealed against itself along at least one other section.

Block Type or Three Dimension Sign. No. 2,778,134. Claude S. Willey, Mount Clemens, Mich. (to Willey Sign Co., Inc., Mount Clemens, Mich.).

The sign letter comprises a base to which is attached a source of illumination, and a plastic channel member covering the illumination. The back of the channel member is formed by shallow, U-shaped ribs joined by sharp valleys which converge the light rays into bright lines. The ribs diffuse them to present a contrasting, soft-light background.

Bearings. No. 2,772,930. Otto Schubert, Sr. and Otto Schubert, Jr., Erlangen, Germany.

A bearing surface is formed by applying a layer of thermosetting resin to a metallic backing surface, and hardening it by heat under atmospheric pressure. The resin contains a comminuted filler to provide a plurality of unoriented capillary passages, some of which are interconnected while others discharge to the surface of the layer. The layer is thus capable of taking up lubricant and discharging it during movement of the sliding surfaces.

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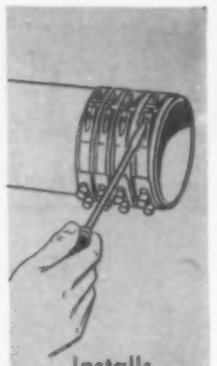

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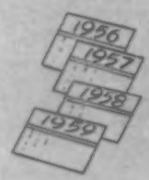

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Resins & Molding Compounds

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CALENDAR of COMING EVENTS

Oct. 3
SPE Western New England Section. Terrace Rm., Bradley Field, Windsor Locks, Conn.

Oct. 4
SPE Southern California Section. Scully's Restaurant, Los Angeles, Calif.

Oct. 7-9
Paper-Plastics Conference, Technical Assoc. of the Pulp & Paper Industry. Sheraton-Gibson Hotel. Cincinnati, O.

Oct. 8
SPE Milwaukee Section. Bavarian Club, Milwaukee, Wisc.

Oct. 10-11
SPI annual New England Section Conference. Wentworth Hotel, Portsmouth, N. H.

Oct. 11
SPE Connecticut Section. Hotel Barnum, Bridgeport, Conn.

Oct. 14
SPE Cleveland-Akron Section. Spanish Tavern, Brecksville, O.

Oct. 16
SPE New York Section. Governor Clinton Hotel, New York, N. Y.

Oct. 17
SPE Pittsburgh Section. Cappy's Restaurant, Pittsburgh, Pa.

Oct. 21
SPE Upper Midwest Section. Warwa's Cafe. Minneapolis, Minn.

Oct. 22
SPE Philadelphia Section. Franklin Inst., Philadelphia, Pa.

Oct. 23
SPE Quebec Section. Queen's Hotel, Montreal, P. Q., Canada

Oct. 30
Reinforced Plastics Group, SPE New York Section. Tufaro's Restaurant, Corona, L. I., N. Y.

Domestic Production and Sales of Plastics and Resin Material, April and May, 1957

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of April and May, 1957. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

A year ago production and sales of cellulosics was slightly under 1957 figures; phenolics slightly higher; urea and melamines a little lower; styrenes were appreciably higher; vinyls, polyesters, and polyethylenes were much lower; and the over-all picture was about 15% lower than now.

	April, 1957		May, 1957	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cllulose acetate and mixed ester:				
Sheets, under 0.03 gage	1,703,261	1,436,827	1,510,191	1,527,265
Sheets, 0.003 gage and over	1,554,943	1,459,261	1,585,234	1,570,160
All other sheets, rods, and tubes	564,787	613,983	562,254	585,020
Molding and extrusion materials	7,167,567	7,114,722	7,672,481	7,511,843
Nitrocellulose sheets, rods, and tubes	357,097	329,555	412,186	375,579
Other cellulose plastics	527,617	459,880	465,567	481,027
TOTAL	11,875,272	11,414,838	12,207,913	12,050,894
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	13,294,421	14,731,741	15,559,098	16,451,848
Bonding and adhesive resins for—				
Laminating (except plywood)	5,012,669	3,951,163	5,170,518	4,314,076
Coated and bonded abrasives	1,449,349	1,252,315	1,859,965	1,623,722
Friction materials (brake lininings, clutch facings, and similar materials)[7]				
Thermal insulation (fiber glass, rock wool)	4,195,360	3,857,968	4,038,888	4,199,208
Plywood	4,154,831	3,327,198	4,428,255	3,534,281
All other bonding and adhesive uses	4,608,596	4,653,197	5,164,081	5,098,659
Protective-coating resins, unmodified and modified except by rosin	2,401,613	2,083,705	3,071,982	2,163,224
Resins for all other uses	2,726,562	2,634,222	3,030,053	2,502,042
TOTAL	37,843,301	36,491,509	42,322,840	39,887,060
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	3,344,321	2,830,681	3,368,053	2,910,580
Paper-treating and Paper-coating resins	1,965,421	1,681,360	1,888,277	1,909,536
Bonding and adhesive resins for—				
Plywood	9,324,405	9,033,519	8,491,768	7,837,384
All other bonding and adhesive uses, including laminating	2,235,715	2,577,167	1,911,896	2,369,833
Protective-coating resins, straight and modified	3,190,940	2,150,635	3,050,401	2,087,631
Resins for all other uses, including molding	7,347,107	8,015,610	8,310,893	8,133,992
TOTAL	27,407,909	26,288,972	27,021,288	25,249,156
Styrene Resins:				
Molding materials[1]	36,652,709	35,651,931	35,321,842	33,014,539
Protective-coating resins, straight and modified	7,272,805	6,839,368	7,389,264	7,644,055
Resins for all other uses	12,218,090	10,669,257	13,276,171	10,929,903
TOTAL	56,143,604	53,160,556	55,987,277	51,588,497
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		7,036,420		7,641,421
Sheeting (resin content)		4,190,687		3,764,902
Molding and extrusion (resin content)		18,393,296		18,218,169
Textile and paper treating and coating (resin content)[3]		4,615,569		4,628,023
Flooring (resin content)		7,889,657		7,518,599
Protective coating (resin content)		3,495,028		3,227,494
All other uses (resin content)		4,254,063		4,388,412
All other vinyl resins for—				
Adhesives (resin content)		4,210,782		3,404,008
All other uses (resin content)		8,974,724		10,371,166
TOTAL	67,640,279	63,060,226	71,363,023	63,162,194
Coumarone-Indene and Petroleum Polymer Resins	22,174,005	22,406,062	23,586,127	23,855,958
Polyester Resins	8,961,157	7,594,628	8,525,310	8,392,778
Polyethylene Resins	51,792,818	54,555,030	56,170,090	59,504,001
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1, 4]	3,825,285	3,905,263	3,731,226	3,637,763
Protective-coating resins[5]	1,057,090	526,896	940,301	599,314
Resins for all other uses[6]	11,885,594	10,722,859	11,386,998	9,643,335
TOTAL	99,695,949	99,710,738	104,340,052	105,633,149
GRAND TOTALS	300,606,314	227,066,613	313,242,393	297,570,950

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
SOURCE: United States Tariff Commission, Chemical Division.

INDEX TO ADVERTISERS*

SEPTEMBER, 1957

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Agency: Leonard Advertising Agency

Allied Chemical & Dye Company
Semet-Solvay Petrochemical Division 702
Agency: Atherton & Currier

Argus Chemical Corporation 707
Agency: Greer Du Bois & Company, Incorporated

Bakelite Company 693-4-5
Division of Union Carbide Corporation
Agency: J. M. Mathes, Incorporated

Cadet Chemical Corporation 736

Celanese Corporation of America
Chemical Division 703
Agency: Ellington & Company, Incorporated

Columbian Carbon Company 749
Agency: Samuel Croot Company, Incorporated

Detroit Mold Engineering Company 698-761

The Dow Chemical Company 699
Agency: MacManus, John & Adams, Incorporated

E. I. Du Pont de Nemours & Company, Incorporated 708
Agency: Batten, Barton, Durstine & Osborn, Incorporated

Eastman Chemical Products, Incorporated
Plastics Division 696
Agency: Fred Wittner Advertising

Emery Industries, Incorporated 739-744-5
Agency: Ruthrauff & Ryan, Incorporated

Engis Equipment Company
Hyprex Division 751
Agency: Central Advertising Service

Erie Engine & Manufacturing Company 692
Agency: The Yount Company

Erie Foundry Company 700
Agency: Lando Advertising Agency, Incorporated

Escambia Chemical Corporation 709
Agency: Godwin Advertising Agency

Flightex Fabrics Corporation 736
Agency: The Powerad Company

General Tire & Rubber Company
Chemical Division 741
Agency: D'Arcy Advertising Company

Gering Products, Incorporated 701-750
Agency: Riedl and Freede, Incorporated

B. F. Goodrich Chemical Company ..... Third Cover
Agency: The Griswold-Eshleman Company

W. R. Grace Company
Polymer Chemicals Division 686
Agency: Kelly Nason, Incorporated

Improved Machinery, Incorporated 734
Agency: Hillsborough Advertisers

H. Kohnstamm & Company, Incorporated 766
Agency: Byrde, Richard & Pound

H. W. Kramer Company, Incorporated 753
Agency: Mitchell Advertising Agency

Marbon Chemical 681
Division of Borg-Warner
Agency: Holtzman Kain Advertising

Metasap Chemical Company 733
Agency: Lewin, Williams & Saylor

Minerals & Chemicals Corporation of America 760
Agency: Richardson, Thomas & Bushman, Incorporated

Monsanto Chemical Company
Organic Chemical Division 690-1
Agency: Gardner Advertising Agency
Plastics Division 704-5-6
Agency: Needham, Louis & Brorby, Incorporated

National Lead Company 688
Agency: Marschalk and Pratt

National Rubber Machinery Company 689
Agency: Ralph Gross Advertising, Incorporated

Ohio-Apex Division 737
Food Machinery & Chemical Corporation
Agency: Advertising, Incorporated

Pantex Manufacturing Corporation 761
Agency: Darrell Prutzman Associates

Paterson Parchment Paper Corporation 747
Agency: Grant & Wadsworth, Incorporated

Plastics Engineering Company 685
Agency: Kuttner & Kuttner, Incorporated

Rubber Corporation of America 765
Agency: Ovesey and Straus, Incorporated, Advertising

Shell Chemical Corporation ..... Second Cover
Agency: J. Walter Thompson Company

Union Carbide Chemicals Company ..... Fourth Cover
Division of Union Carbide Corporation
Agency: J. M. Mathes, Incorporated

Union Carbide Corporation
Bakelite Division 693-4-5
Union Carbide Chemicals Division ..... Fourth Cover
Agency: J. M. Mathes, Incorporated

U. S. Industrial Chemical Company
Polyethylene Division 682
Agency: G. M. Basford Company

U. S. Mica Company, Incorporated 743
Agency: Terrill Belknap Marsh Associates

R. T. Vanderbilt Company, Inc. 746
Agency: H. Edward Oliver

Watlow Electric Manufacturing Company 765
Agency: Batz-Hodgson-Neuwoehner Advertising Agency

Welding Engineers 710
Agency: John Miller Advertising Agency

John Wiley & Sons 761
Agency: Norman D. Waters & Associates

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